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ABSTRACT

This study focuses on the instructional role of computer, video, and audio technologies at the collegiate level in order to understand to what extent and in what ways faculty see these electronic technologies contributing to the solution of important instructional problems. Comments and questionnaire responses from 254 college faculty members provided the basis for the report. The study reveals a high degree of correspondence between the instructional problems college faculty say are most troublesome and the reasons they give for using the technologies. Faculty not only consider them appropriate tools for addressing the most difficult instructional problems, but also value their role in dealing with other important but less troublesome instructional problems. In general, the faculty who participated in this study view the instructional potential of computer, video, and audio technologies quite favorably. However, they are quite critical of the quality of most currently available instructional software materials, particularly computer software. The text is supplemented by 20 statistical tables. Four appendices provide copies of the questionnaires used in the study, software descriptions, and a technology use variable derived from questionnaire scores. (KM)

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FACULTY PERSPECTIVES ON THE ROLE OF INFORMATION TECHNOLOGIES IN ACADEMIC INSTRUCTION

by

Raymond J. Lewis, Director
Learning and Technology Services

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Raymond J. Lewis, Director
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December 1985

prepared for

Corporation for Public Broadcasting
1111 Sixteenth Street N.W.
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EXECUTIVE SUMMARY

This study focuses on the instructional role of computer, video and audio technologies at the collegiate level. It looks at the topic from the faculty perspective. Its purpose is to understand to what extent and in what ways faculty see these electronic technologies contributing to the solution of important instructional problems. It is based on comments and questionnaire responses from 254 college faculty who participated in one of 26 focus group sessions held at 15 colleges and universities throughout the United States during the Spring and Fall of 1985.

Initially, the study identified instructional problems faculty consider most troublesome, regardless of the pedagogical approach they use. Eighty-one (81) faculty from seven colleges and universities identified five instructional problem areas. These included the following: 1) conveying abstract concepts (and relationships between abstract concepts and concrete experience); 2) motivating students and encouraging them to be more active learners; 3) dealing with individual learner differences; 4) encouraging the development of generic skills and abilities; and 5) obtaining support necessary to make faculty more effective teachers.

In the next phase of the study, 173 faculty from eight colleges and universities were asked how they felt about using information technologies to address these and other instructional problems. They were also asked about obstacles to their instructional use of information technologies. Finally, they were asked to suggest steps that might be taken by various constituencies to improve the fit between faculty instructional needs and the instructional software materials available for computer, video and audio technologies.

The study revealed a high degree of correspondence between the instructional problems college faculty say are most troublesome and the reasons they give for using the technologies. Faculty not only consider them appropriate tools for addressing the most difficult instructional problems, but also value their role in dealing with other important, but less troublesome instructional problems. Examples of the latter include the following: 1) helping students appreciate times, places, people and events that cannot be experienced in a conventional classroom; 2) enabling students to experience real-world problems in a safe, manageable or cost-effective manner; and 3) course management.

In general, the faculty who participated in this study view the instructional potential of computer, video and audio technologies quite favorably. However, they are highly critical of the quality of most currently available instructional software materials, particularly computer software. Many faculty made it clear that they value the instructional capacity of video and audio technologies, but the majority are more intensely focused on computers than either video or audio technologies.

Among the faculty characteristics examined in the study, extent of technology use was the most useful variable for explaining faculty responses to questionnaire items. One of the more predictable conclusions derived from the analysis of this variable was that faculty who made greater use of computer, video or audio technologies were also more likely to agree that these technologies can help them overcome various instructional problems.

Faculty identified several obstacles to effective use of information technologies. Among those cited were lack of funds, lack of access to hardware, insufficient incentives and rewards, lack of training, and lack of descriptive and evaluative software information.

The study also revealed that faculty who make greater use of information technologies are less bothered by obstacles that frustrate colleagues with little or no technology experience (e.g., lack of software information, lack of training, lack of incentives and rewards). On the other hand, those making more extensive use of information technologies are more concerned than their colleagues about obstacles that stand in the way of expanded technology use (e.g., lack of on-campus technical assistance, software copyright restrictions).

There was a general consensus that information technologies should be used primarily to supplement faculty. Participants in the study felt that computer, video and audio technologies should be used to help faculty with instructional objectives that they cannot accomplish on their own, or that they prefer not to perform themselves. They do not want technology to perform functions they already perform well on their own or with textbooks.

The study identifies numerous incongruities between the instructional software faculty say they want and the materials currently available from commercial and academic software developers. Among the qualities faculty value most highly when looking for instructional software are quality, flexibility, adaptability, affordability, simplicity and interactivity.

The study contains many suggestions from faculty and recommendations from the author for actions that might improve the fit between faculty instructional needs and technology-based instructional software. These comments are directed to college and university administrators, faculty, educational policymakers, funding agencies, software developers and hardware vendors.

SELECTED QUOTATIONS FROM FACULTY PATRTICIPANTS IN THE STUDY

"I think that we need to recognize that the book is a very efficient technology. It's compact, relatively inexpensive, and portable. You know you are competing with something that is a well-established technology. And I don't think that we should be trying to duplicate with electronics what the book already does. I think it should be looked upon as something totally different."

"I simply would never make the assumption that a particular means of learning is related to the students' ability. I start with what I think is the reverse of that assumption. That is, when I walk into a classroom, I assume that there are literally hundreds of different natural styles of learning and my job is, as a teacher of a large class, to provide as wide a range of learning environments and natural styles as I can.

But I don't think those styles are related to whether they succeed or fail in the class or whether they scored high or low on their SAT tests. So I imagine that there are very able and creative students that profit from learning through technology and some not-so-able students. What matters is how people naturally learn and, from an instructor's point of view, how you use technology to supplement your weaknesses.

The reverse of that is that the teacher has natural teaching styles. The problem for a teacher is to expand what you are naturally good at to include those teaching styles out there that you don't naturally teach. So that the technology fits in that grid by helping you and helping them. I don't think it has anything to do with being smart or not so smart."

"In dealing with large classes I spend most of my time trying to make it a personal situation. I think that the interjection of mechanical, alien devices cause you more trouble than they are worth. From my point of view for a big class I want it to do two or three things for me: One, I already have -- it keeps all my records for me. That is when I have to calculate 350 grades. It can help me to do that. That for me is saving two days worth of work right there and so I love it.

The second is that I want the technology to help me outside the classroom. In particular, to substitute for me in the way that I can make personal judgments, and I do make them. To the degree that technology can keep a record of students' prior performances and help them with a special set of problems that they could work on outside of class, I find that attractive.

And the third way is that I have a particularly big introductory course and I think in any discipline there are all sorts of concepts, words, rules, data that are just essential to being able to deal inside that discipline. The only way you learn them that I know of is through some sort of rote application of some sort or another. I hand them a handwritten study guide where I urge, conjole, and then personally try to motivate students to do this exercise night after night to learn it. To the degree that a computer or some sort of technology could excite students and make them willing to invest more time on this exercise than the sheer drama of my personality can get them to do, I would find that helpful."

"Two years ago I had a grant and I developed about 13 hours of audiotape and videotape software that I use in my Introduction to the Theatre class. And it has really proved invaluable because now I've gone from small group sessions of three hours a week to large lecture sessions of two hours a week. It provides me the expansion of materials that I really needed and it increases my teaching time by one-third without my having to be there. It provides a lot of information that would take up an excessive amount of class time. Students do projects -- two large projects based on it and a long paper -- and I view those personally in my office so that it is interactive with me also. I love the use of it, but my problem is that there really isn't enough hardware on campus and there is always a crunch to get use of that module in the second semester."

"There are two big questions: Finding out what's there and finding out what's good. I have found that one of the biggest impediments to using technology is just what is out there. If you want to find a book you generally feel you can go to a library where there is a central card catalogue that lists everything and if it's not there you can find out through a centralized library. The same is generally true for video material. But in terms of computer materials, you sometimes go to MECC, sometimes to the computer center or sometimes you contact a person at Iowa or Washington or California or Illionis. You go all over the place. I found that finding out what's there is the hardest thing; 90% of what people find is serendipitous.

What is needed is some sort of centralized catalogue. It would be nice if the first thing faculty members at the University of Iowa thought about when they reviewed some software was to make a reference and send it to some centralized clearinghouse, run by a professional society -- maybe a biological society or a musical society, or something like that.

And the second thing is what's good. Because, again,I think that 95 to 99% of the stuff is really crap. I mean it's in, it's hot, somebody throws together a program that looks good because it has a nice front end, it seems good, but when you get inside, it is really poor. Some of the mechanical things, finding out what's there and if it is academically sound....are such large impediments that some faculty just say, "Forget it."

"I teach chemistry. Many of the software programs are very slow and simplistic. In the courses I teach I have to take 20 minutes to teach the basics. With a computer it would take several hours to do the same thing. I am talking about in-class use. I think computers are great for repetition to learn one particular area. But the problem even then is that the student sitting with the computer has to take several hours. For the time they spend when they come out they have learned things that are covered in the first half page of the textbook.....I find that there is not enough good material available which deals with the more complicated concepts."

"When I look at a program, I judge it on the basis of whether or not it could be accomplished with a cheaper technology. I have seen so many math programs that are simply electronic flashcards. That is counter-productive for the amount of time that people put into the program and the time and money it takes to produce it. If a kid can use a flashcard, forget the technology. I use audiotapes in my (Education) methods classes to bring discussions into the classroom. My students can't see the kids but they can hear them talking. I can't bring real live kids into the classroom -- and I think that's great because I get something that I can't get any other way, but for a very cheap price."

"I am told that on this campus microcomputers are popping up all over the place. However, disks are not popping up, ribbons are not popping up, paper is not popping up, maintenance contracts are not popping up, software is not popping up -- without which it won't work. All of this is laid down and departments responsible for those machines are asked to make it work out of the expense budgets that were given to them before the machines showed up."

"The problem is that individual colleges want all the freedom and flexibility that goes with owning their own hardware and software, but none of the problems that are associated with localized maintenance and repair and on-going support. You know it's unfortunate that centralized computer is not so user friendly that you get the same feeling working with it that you get with using your own system. But there's this fixed pile of money out there and if colleges get it to buy micros it does not go into centralized support for computing. One is always hurt at the expense of the other."

"In terms of the control of the equipment and software and such -- what really needs to be controlled is the information. That's what needs to be systematic. Unless you have a common pool of information -- given the way universities do business -- individual faculty tend to follow their own path ("Don't tell me how to teach this course.").

"Well, let's take the example mentioned before. Harvey has that problem. Some guy in another department at another college has the same problem. But neither one of them know about it. So we re-invent the wheel every time that we run into this thing. Coordination of information is what I think should be centralized. I don't know about centralizing the equipment and facilities and that sort of stuff. I kind of like it distributed. But it's the access to information that should be centralized".

"We have an excellent mainframe in terms of potential, but there's nothing much on it. Nothing comes off the mainframe..... the instructional packages don't come off mainframes at all. We have a 100 terminals ... and we can't send the students to do anything on them as far as that kind of work is concerned. The mainframe is a terrible word processor -- it's real primitive."

"I don't know whether the technology is there to make these things readily adapted and modified. I look forward to when the technology gets to the point you can have a package delivered to you and then as part of the documentation it tells you --"here is a relatively easy way to go in and change it." I don't think we are there yet, but I would hope that that's one of the ways that things will develop."

"It's my experience that currently software publishers are trying to piggyback computer software or videotapes onto successful textbooks. I believe, but I haven't tested this, if you start from the very moment that you are planning the textbook with the idea that these technologies are going to be integrated into the plan with the same team of people working on it -- you will build a textbook that will presume these technologies. I think that would be a tremendous step in the right direction. ....I think that's the direction that publishers should go."

"The whole educational system is not set up to deal with technology. First of all, there are no rewards in the system right now for those who create to be creative. Secondly, the machinery (starting with the state, all the way through the university administration to the academic departments) that distributes funds and makes things available to those that create and do the teaching (the front line people) is not there. The existing machinery is reluctant to change. People are unwilling to face it.

Things will change because the momentum is there. But at this rate it will take years; it will be messy, frustrating and aggravating."

I. INTRODUCTION

A. The Higher Education Environment

In the mid-1980s higher education is witnessing the convergence of a number of trends, each of which affect college faculty in some way. If these patterns were to occur separately, they might not greatly affect the role college faculty have traditionally played. The fact that they are converging at roughly the same time leaves little doubt that faculty are likely to experience some profound changes in the near future.

Some of the trends affecting higher education today include the following:

* A declining proportion of 18-22 year olds in the population
* An increasing proportion of part-time and adult learners with limited time for educational activities
* A general down-turn in the national economy
* Severe fiscal constraints affecting most federal, state and institutional budgets
* Declining opportunities for faculty career advancement due to high rates of tenure
* Declining opportunities for job mobility from one institution to another
* Increasing proportion of unionized faculty members
* Increasing use of part-time and adjunct faculty
* Declining levels of academic preparation among entering freshmen
* Rapid growth of education and training activities in the corporate sector
* Growing public criticism of the quality and relevance of the higher education curriculum.

Recent national studies and commissions have focused attention on the impact these trends are having on higher education in general, and on teaching faculty in particular. This wave of attention has already stimulated many suggestions for improvements.

In the search for ways to improve higher education and to enhance the position of college faculty, it is important to keep in mind another trend. "The information technology revolution," as some refer to it, is having a significant impact on many sectors of our society, including higher education.

Computer, video and audio technologies are by no means a cure for all the ills of higher education. However, the expanding availability of these technologies and related software materials is generating new professional development opportunities for college faculty (e.g., alternative teaching roles, teaching improvement resources, productivity tools, new research topics, job retraining options, marketable skills, etc.).

Future prospects for job satisfaction among college faculty may depend in part on whether we learn to effectively integrate computer, video and audio technologies into higher education in a manner that responds to faculty needs. This study examines, from the perspective of college faculty, some of the issues that are critical to this integration process.

B. Purpose of the Study

The purpose of this inquiry is to better understand the appropriate role of information technology in higher education instruction. It does so by meeting with college faculty in small focus groups in order to view the topic from their perspective.

Initially the study looks at generic instructional problems facing college faculty. After establishing what these instructional problems are, it examines how information technologies fit into instruction at the college level.

More specifically, the study sheds light on some of the following questions:

* How do faculty feel about using information technologies in college instruction?
* What do faculty feel are appropriate instructional uses of computer, video and audio technologies at the college level?
* What factors hinder faculty in using these technologies for instructional purposes?
* What suggestions do faculty have for effectively matching information technologies with their instructional needs?

C. Structure of the Study

This study was divided into three phases:

1. Phase I - Identifying Instructional Problems

Phase I of the study involved two activities. The first was a search of the teaching effectiveness and improvement literature of higher education. The second was interviews with higher education researchers interested in teaching improvement. Both were aimed at identifying generic instructional problems faced by faculty in all disciplines.

2. Phase II - Refining and Prioritizing Instructional Problems

During Phase II the principal investigator conducted a total of ten focus groups of faculty at seven colleges and universities, involving 81 faculty. The purpose of these focus groups was to refine the list of instructional problems and to determine which were most important to college faculty.

The faculty participants in each 90-minute session responded to a short questionnaire and participated in a discussion about their instructional problems. This information was used to refine and prioritize the list of instructional problems.

3. Phase III - Relating Information Technologies to Instructional Problems

After identifying in Phase II some of the instructional problems faculty view as most persistent, the study's focus shifted to an examination of the relationship between faculty instructional needs and

available technology-based instructional software. In Phase III of the project 173 faculty from eight colleges and universities participated in 16 focus groups. Two separate focus groups gathered at each institution: one for faculty form the social sciences, humanities and fine arts and another for faculty form the sciences, math and business.

Participants in each two-hour focus group viewed a videotape, completed a questionnaire and took part in a discussion. First, a 35-minute videotape illustrated 12 examples of computer, video and audio software currently used for instruction at colleges and universities. The content of the videotapes was tailored to the academic area of the participants; one tape contained examples from the social sciences, humanities and fine arts while the other contained examples from the sciences, math and business. (Refer to Appendix C for listings of the software included on the two videotapes.) This provided a common frame of reference for the subsequent focus-group activities.

Next, the participants filled out a 40 item questionnaire asking them questions about their attitudes toward instructional uses of computer, video and audio technologies. Most of the questions dealt with two issues: 1) reasons for using information technologies for instruction, and 2) obstacles to the effective use of these technologies. (Refer to Appendix B for a copy of the questionnaire, to Table 15 for a summary of the responses to the Reasons question and to Table 16 for a summary of the responses to the Obstacles question.)

Finally, participants discussed instructional applications of information technologies. The 50-60 minute discussions focused on factors that enhance or hinder facultys' instructional use of information technologies. Faculty also were asked to suggest strategies for improving the fit between what they want from the technology and what it is currently able to do for them.

D. Characteristics of the Faculty Participants in the Study

1. Selection Criteria for Participants

This study is based on information gathered from a representative group of college faculty from 15 institutions located in 10 different states. It is <u>not</u> a scientifically drawn sample of faculty.

The critical ingredient in attracting these 254 faculty was their willingness to attend an hour-and-a-half (Phase II) or a two hour (Phase III) focus group discussion with colleagues and an educational researcher. From the beginning, the issue of motivating faculty to attend the focus group sessions was of critical importance.

The selection procedure and criteria for participants in both Phase II and III focus groups were basically the same. The principal investigator asked someone familiar with faculty at each institution to invite participants. These were usually people in the office of the chief academic officer or people with responsibility for faculty development activities on campus.

The following selection criteria were communicated to each campus contact person:

* Faculty from a broad cross-section of academic departments
* Faculty with varying degrees of exposure to information technologies; special emphasis was placed on including faculty with little or no prior experience
* Faculty who were interested in teaching and learning issues (This criterion was more critical in Phase II than III.)

2. Phase II Focus Group Population

Phase II focus groups involved seven institutions located in six states. Three were four-year public universities and four were public community colleges. Plans called for, but due to cancellation did not include a private four-year institution.

Phase II included a total of 10 focus groups with an average of eight faculty per group. A total of 81 faculty participated in the 90 minutes sessions during the Spring of 1985. For additional information about the faculty and institutions, please refer to Tables 1 and 2 at the end of this report.

3. Phase III Focus Group Population

Phase III involved 173 faculty from eight institutions located in four different states and took place in the Fall of 1985. Three of the institutions were four-year privates, three were four-year publics and two were two-year publics. Of the 173 participants, 29 percent were from four-year private institutions, 43 percent were from four-year public institutions and 28 percent were from two-year public colleges.

The faculty came from a wide variety of disciplines; 55 percent from the social sciences, humanities and fine arts and 42 percent from the sciences, math, engineering and business. For more demographic information about the Phase III faculty refer to Tables 3 - 9 at the end of this report.

E. Technology Use Characteristics of Participants in the Study

On the Phase III questionnaire faculty were asked to indicate the extent to which they use information technologies in their courses and the extent to which they encourage or require their students to do so. By combining the responses from this question, we were able to assign each respondent to one of three categories: non-user, moderate-user and heavy user.

The percentage of computer use was greater among faculty at four-year private institutions, in the sciences and math, and surprisingly enough, among faculty with 20 or more years teaching experience. The latter group was followed closley by faculty with 0-10 years teaching experience.

The percentage of faculty using video technology was greatest among faculty at two-year colleges and faculty in the fine arts and humanities and faculty with 11-20 years of teaching experience. The pattern for audio and video technologies was roughly the same.

II. WHAT FACULTY SEE AS THEIR MOST TROUBLESOME INSTRUCTIONAL PROBLEMS

A. Identifying Instructional Problems

The first major task of this study was to identify the instructional problems that college faculty feel are most difficult to solve. The focus was on generic problems that they experience, regardless of their academic field.

Phase I of the study included a search of higher education literature and interviews with researchers interested in teaching-effectiveness issues. Out of these efforts an initial list of 21 instructional problems emerged. (Refer to Appendix A.)

B. Prioritizing Instructional Problems

Faculty who participated in the seven Phase II focus groups were asked to respond to a questionnaire containing the initial list of 21 instructional problems and to suggest modifications or additions to the list. They were asked to indicate the extent to which they agreed or disagreed that each item was a problem they have encountered in their teaching. They could choose from four alternatives: strongly agree, agree, disagree and strongly disagree. These responses were weighted 4, 3, 2 and 1, respectively.

Item	Mean	Rank
Motivating students to learn in unstructured settings (e.g., home, libraries)	3.10	1
Teaching a class of students that includes a wide variety of learning abilities and learning styles	3.07	2
Conveying relationships between theory and practice (e.g., getting students to apply theoretical concepts to concrete experiences)	3.04	3
Conveying abstract concepts	2.93	4
Teaching students to reason inductively (e.g., proceeding from discrete facts to generalizations)	2.90	5
Encouraging the development of specific abilities (e.g., problem-solving, analysis, writing, listening, visualizing, social interaction)	2.89	6
Achieving more effective teaching without vast expenditures of faculty time	2.80	7
Engaging students in active modes of learning (e.g., question-asking, dialogue with other students, team learning)	2.78	8
Motivating students to learn in structured settings (e.g., classroom, labs)	2.74	9
Devising instructional strategies that respond to individual student differences	2.74	10

Item	Mean	Rank
Obtaining professional rewards for making efforts to teach more effectively	2.72	11
Assessing individual student differences in learning abilities, learning styles and developmental stages	2.69	12
Encouraging students to extend their learning beyond traditional disciplinary boundaries	2.62	13
Finding a common frame of reference with students that facilitates communication and learning (e.g., people, events or ideas that students recognize)	2.48	14
Overcoming student resistance to learning approaches that vary from the traditional didactic, lecture-based approaches	2.38	15
Gaining access to informational materials necessary to support instruction (e.g., print, illustrations, data)	2.36	16
Encouraging students to experience real-world problems in a safe, manageable and cost-effective manner	2.30	17.5
Evaluating learning outcomes (e.g., skills, knowledge)	2.30	17.5
Managing the administrative logistics of instruction (e.g., grading, record keeping)	2.27	19
Conveying an appreciation for times, places and events that cannot be experienced in the current learning environment (e.g., other cultures, historical events)	2.11	20
Conveying factual information	2.03	21

After indicating the extent of the agreement or disagreement with the questionnaire items, faculty focus-group participants rank-ordered the five instructional problems they found most troublesome. The results of this process served to reinforce the pattern described above.

Five general instructional problem areas emerged from the analysis of questionnaire responses from 81 faculty at seven colleges and universities. They include the following:

	Mean Score	Rank
* Abstract/Concrete		
Conveying abstract concepts	2.93	4
Conveying the relationship between theory and practice	3.04	3
Teaching students to reason inductively	2.90	5

* Motivation/Active Learning		
Motivating students to learn in unstructured settings	3.10	1
Motivating students to learn in structured settings	2.74	9
Engaging students in active modes of learning (e.g., question-asking, dialogue with other students, team learning)	2.78	8
* Individual Learner Differences		
Assessing individual student differences in learning abilities, learning styles and developmental stages	2.69	12
Devising instructional strategies to respond to individual student differences	2.74	10
Teaching a class of students with a wide variety of learning abilities and learning styles	3.07	2
* Generic Skill Development		
Encouraging the development of abilities (e.g., problem-solving, analysis, writing, listening, visualization, social interaction)	2.89	6
* Faculty Support and Effectiveness		
Obtaining professional rewards for making efforts to teach more effectively	2.72	11
Achieving more effective teaching without vast expenditures of time	2.80	7

This group of problems, along with a few lower-ranking problems, were subsequently included in the Phase III questionnaire. The results from Phase III are discussed in the next section of this report.

III. HOW FACULTY VIEW INFORMATION TECHNOLOGIES

A. General Feelings of Faculty toward Information Technologies

In the Phase III focus groups faculty were not just merely discussing the role of information technologies in society at large. They were talking about where computer, video and audio technologies fit into their day-to-day professional lives. Not surprisingly, faculty expressed many intensely held opinions.

In the focus groups faculty volunteered many negative comments about information technologies in general, and they were particularly negative about the current role these devices play in academia. Nevertheless, it is clear from their responses to the questionnaire items and from their discussion comments that most of these faculty are basically optimistic about the contributions information technologies can potentially make to higher education. Their attitudes might best be described as intensely critical of what exists and guardedly optimistic about future possibilities. The exceptions were those who were extremely committed or extremely opposed to the instructional use of information technologies.

In the discussion sessions it became apparent that most faculty are ambivalent toward electronic technology. On the other hand, faculty are attracted by the potential to motivate student interest in learning. As teachers they appreciate the role technology can play in helping students to visualize complex relationships, to actively experiment with elusive physical and social phenomena and to master important skills.

On the other hand, many of the same faculty express deep reservations about the way the technologies have encouraged behaviors they see as antithetical to the goal of educating discerning citizens. Passivity, poor reading and writing habits and preferences for predigested information are among the contemporary societal ills to which they see computer, video and audio technologies contributing. Unfortunately, these misgivings have all too often been reinforced by faculty exposure to ineffective instructional applications of computer, video or audio technologies.

The information presented in the rest of this study paints a more detailed picture of faculty views on the subject. In addition to detailing their positive and negative comments, the study offers suggestions from the same faculty about how educational applications of information technologies might be improved.

B. A "Guiding Principle" for Faculty Use of Information Technologies

The 173 faculty who participated in the 16 Phase III focus groups expressed divergent views about the proper role of computers, video

and audio technologies in education. This diversity makes it difficult to briefly summarize their views.

However, on one point there was a clear consensus. When asked what they wanted the technologies to do for them, there was almost unanimous agreement. Faculty want information technologies to do things for them that they cannot do for themselves. Many faculty would add their own refinements to this statement, but almost all would agree with it in its simplest form.

Implicit in this point of view is the assumption that the technology should only be used to supplement the faculty member. Many faculty were, in fact, very explicit about their conviction that the technology should not be used to replace functions already performed satisfactorily by faculty members. Not surprisingly, faculty do not want to be replaced by technology; they want it to perform in a supplementary capacity.

Some faculty refine the guiding principle by expanding it to include the textbook as well as the faculty member. They maintain that information technologies should not attempt to do those things that faculty and their textbooks already do. It is their view that electronic technologies should not be used to convey large blocks of course content that can be effectively delivered by a print or lecture mode. They are particularly opposed to what they refer to as "electronic page-turning"; computer or video screens that are very print-heavy and offer the student little more, or even less, than the traditional printed page.

Others would modify the guiding principle by stating that information technologies should also be used in those cases where they can do something better than the faculty member can. For instance, a chemistry or physics professor may be able to describe the structure of molecules by using a combination of words and physical models. However, some faculty maintain that if a computer simulation or video sequence can more effectively convey the same information, then it is appropriate to use the technology.

Another variation is offered by faculty who feel that information technologies should also be used to perform tasks they would rather not spend their time on. For the most part, these are repetitive tasks associated with remediation and classroom teaching and management.

Finally, some say information technologies should also be used to emulate situations that occur in the world of work. They stressed importance of preparing students for conditions they will encounter when they graduate. For example, a student of manufacturing design should be exposed to computer-assisted design and manufacturing procedures just as a student of journalism should be exposed to word-processing.

The vast majority of the focus group participants would probably be willing to subscribe to these variations of the basic guiding principle. However, we should not overlook the fact that there are some faculty who maintain there are no appropriate roles for information technologies in higher education. Likewise, there are others who advocate using technology to automate entire courses. As you might suspect, in the focus groups faculty expressed all shades of opinions along this continuum.

C. Faculty Reasons for Using Information Technologies

1. To Increase Productivity

Both the focus group discussions and the questionnaire responses revealed that one of the primary reasons faculty give for using information technologies is to increase the effectiveness of the teaching and learning process. Many faculty view electronic technologies as tools to help them manage their course recordkeeping, to address a wide range of student learning needs and to enhance their ability to communicate information. Some faculty also pointed out ways in which they felt information technologies helped students make more effective use of their time.

The term "productivity " seldom, if ever, arose in the focus group discussions. However, it was clear from their comments that many faculty value the extra service capacity these technologies bring to academia. It is apparent that many faculty view computers, video and audio technologies as "productivity tools," even if they avoid the terminology.

Judging from their comments, faculty are very attuned to anything that affects the way they spend their time. Just as they complain about the time involved in learning about and using information technologies, they also wax eloquent when they find ways these same technologies can help them gain more control over their own schedules.

One clear indication that faculty value the capacity of information technologies to improve academic effectiveness can be found in the responses to three questionnaire items. A large percentage of the respondents agreed that these items were reasons for incorporating information technologies into their courses.

	Percentage Agreeing		
	Computer	Video	Audio
To increase my effectiveness as a teacher	86	82	68
To make it easier to deal with differences in the learning styles and abilities of students in the same class	68	64	53
To help me manage my courses (e.g., grading recordkeeping, assessment, diagnosis)	70	35	32

The fact that the highest percentage of agreement went to computer technologies is consistent with the response pattern on almost all items. Understandably, this is even more the case with the item about course management. On the other two items, approximately two-thirds to four-fifths of the respondents in this study agree that computer and video technologies can help them increase their productivity.

A closer look at the teaching effectiveness item reveals that science, math and business faculty view computers more favorably for this purpose. Similarly, respondents from the social sciences, humanities and fine arts view video and audio technologies more favorably. Not surprisingly, there is much more agreement on both the teacher effectiveness and the course management items among faculty who use information technologies than there is among those who are non-users.

In the focus groups, faculty cited numerous teaching tasks they preferred to have performed by information technologies. These include some of the following: repeating procedural information (e.g. lab instructions), conducting remedial instruction, conducting drill and practice, facilitating problem-solving exercises, assessing student skills and knowledge, prescribing individualized learning plans, providing feedback and managing course records.

Numerous faculty commented on how information technologies can increase student, as well as faculty, productivity. Faculty from a variety of disciplines indicated that they felt word processing is a marvelous tool for helping students make better use of their time while at the same time improving their writing. Some science and math faculty advocated using the computer as a tool to speed up arithmetic calculations during classroom, laboratory and homework exercises. In their view, people should do the analytical thinking and the computer should be used to increase human productivity; this applied to faculty as well as students.

2. To Motivate Students

Motivating student to learn was one of the instructional problems faculty identified as particularly troublesome in the Phase II focus groups. Judging from comments in Phase III focus groups and responses to questionnaire items, most faculty feel information technologies can help them address this problem.

	Percentage Agreeing		
	Computer	Video	Audio
To motivate students to be more interested in the content of the course	79	82	67
To encourage students to be more active learners	80	66	55

On both of these items the extent of agreement increased with the level of technology use; the more faculty use any of these technologies, the more convinced they seem to be that they help to motivate student learning. Social science, humanities and fine arts faculty stress the role of video and audio technologies more than do their colleagues in the sciences, math and business.

In the focus-group discussions faculty stressed the importance of engaging students in the learning process. They seemed especially to appreciate computers' ability to get students into an interactive learning mode. In fact, some of their most critical comments were directed at educational applications of computers that did not utilize this capacity for interactivity to its fullest.

Many faculty were critical of the lack of interactivity associated with various instructional applications of video technology. Nevertheless, most recognized and appreciated the capacity of video to get students more emotionally and intellectually engaged than is often possible with conventional teaching methods.

3. To Convey Generic Skills

In Phase II of this study faculty identified generic skills like problem-solving, analysis, writing and visualizing as being particularly difficult to teach. Many faculty participants in Phase III indicated that they agreed with a questionnaire item stating that conveying such skills is a reason for using information technologies in their courses. Of the 173 participants in this phase of the study, 83 percent agreed that conveying these skills is a reason to use computer technologies; the percentages for video and audio technologies were 72 and 62, respectively.

4. To Convey Complex Concepts

In the Phase II focus groups faculty indicated that one of instructional problems they found most troublesome was trying to convey complex concepts to students. On the Phase II questionnaire faculty ranked three items dealing with the teaching of conceptual information third, fourth and fifth in importance out of 21 items.

The data from the Phase III focus groups make it clear that many faculty respondents believe computer, video and audio technologies can help them deal with this important problem area.

	Percentage Agreeing		
	Computer	Video	Audio
To help convey relationships between abstract theory and concrete experience	79	78	58
To help students learn important concepts or skills that are difficult to master	79	73	61

As we already mentioned, most faculty think that the appropriate role of information technologies in higher education is to do things that they cannot easily do themselves. Many participants in the study reported that that they use video and computer software to help students visualize complex concepts that are difficult to convey using a blackboard or an overhead projector.

5. To Expand the Learning Environment

In Phase III, where information technologies were the focus of the conversation, faculty participants gave many indications that they highly value the ability of computer, video and audio software materials to expand the parameters of the classroom and the campus. However, the two items that dealt with expanding the learning environment were not among the instructional problems that faculty ranked high in the Phase II focus groups.

Even though the items were stated almost exactly the same way in both questionnaires, in Phase II they both ranked in the lower fifth (tie for 17th and 20th out of 21 items). As the following data illustrates, well over half of the Phase III respondents agreed with the reasons stated in these two items.

	Percentage Agreeing		
	Computer	Video	Audio
To enable students to experience real world problems in a safe, manageable and cost-effective manner (e.g., simulations, experiments)	74	65	54
To help students appreciate times, places people and events that cannot be experienced in a conventional classroom	65	81	58

It is interesting to note that on the second of the two items the percentage agreeing is much higher for video than for computer technologies, one of the few instances this occurred. Evidently faculty in this study feel strongly that video is much more appropriate for conveying an appreciation for the world beyond the classroom.

The idea of expanding the learning environment seems to fit very well within the "guiding principle" of technology use reiterated by so many focus-group faculty. One of the most difficult things for faculty to do by themselves is to help students experience phenomena that cannot occur in a classroom. Many faculty mentioned that they use computer, video and audio technolgies to help student visualize phenomena that are too slow, fast, small, large, expensive or dangerous to be easily demonstrated in the classroom. Others use these technologies to get students actively involved in exercises that simulate complex relationships in the world beyond the campus.

6. Low-Ranked Reasons

Among the 14 reasons for incorporating information technologies into their courses, three items were not ranked very high by faculty. On each of these items less than 70 percent agreed that the statement described a convincing reason for using either computers, video or audio technologies for instruction.

Approximately 60 percent (computer 58, video 62 and audio 58) of the faculty agreed that delivering instruction to students in off-campus settings was a reason to incorporate information technologies into their courses. Because we did not ask respondents whether or not they taught courses in off-campus locations, we do not know what their experience has been with this kind of activity. The fact that 89 percent of the Phase III respondents indicate they are full-time faculty suggests that a disproportionately small percentage of the respondent population are involved in off-campus delivery of instruction.

Judging from faculty responses to the item about increasing opportunites for student-facuty interaction, neither computer, video or audio technologies rate highly on this dimnension (computer 44 percent, video 42 percent and audio 35 percent).

Faculty participants in the study left little doubt about whether they thought they needed to respond to student expectations about technology use in college. Most do not think that they should incorporate computers or other technologies into their courses to satisfy real or imagined student expectations. The percentages agreeing with this reason were 46 for computer, 38 for video and 31 for audio.

IV. WHAT FACULTY CONSIDER OBSTACLES TO THEIR USE OF INFORMATION TECHNOLOGIES

A. Faculty as Obstacle

When asked what factors hinder their use of computer, video and audio technologies, faculty who participated in the focus groups had a great deal to say about their institutions and about educational software materials. However, they made few explicit comments about the impact of their own attitudes or behaviors on their instructional use of information technologies. Consequently, this study is limited in what it can say about how faculty themselves undermine the process of integrating information technologies into the curriculum.

The questionnaire given to all Phase III focus group participants contained a question listing 15 factors as potential obstacles to faculty use of computer, video and computer technologies. Only one of the these items focused on the faculty member's attitudes as a potential obstacle. It dealt with the faculty member's own concerns about the long-term negative impact of these technologies on higher education. Over four-fifths of the faculty indicated they did not agree that this was an obstacle to their use of these technologies. Of the 15 potential obstacles listed in the question, this one ranked the lowest.

Only a few of the 173 faculty who participated in the Phase III focus groups volunteered information about how their own attitudes hinder more extensive use of computer, video and audio technologies. For example, an economics professor who has successfully adapted an existing computer simulation for use in his own classes described how difficult it had been for him in the beginning. As someone who was accustomed to being perceived by students as "the expert" in the topic at hand, he said it was particularly difficult to place himself in a situation where he obviously did not have the same degree of mastery over the hardware and software that he did over the subject matter.

Some faculty voiced their own fears about the impact extensive use of these technologies might have on their jobs. They said they were concerned with the possibility that not only might the traditional role of the teacher undergo radical changes, but also their jobs might be eliminated in favor of some videotape or computer program.

A few faculty said they were philosophically opposed to the use of information technologies for instruction. Others were not opposed to students using the technology, but felt very strongly that the classroom was no place for computer, video or audio technologies. This group felt that as faculty they have an obligation to communicate directly with their students and should be able to do so effectively without the assistance of technology. Faculty who shared these kinds of objections to the use of information technologies were also critical of the current state of educational software materials.

It is not surprising that faculty expressed negative feelings about information technologies. After all, most faculty have highly developed critical thinking skills and might be expected to resist the introduction of hardware and software into the environment with which they are most familiar -- the classroom and the campus. What is surprising from listening to their comments and reviewing the questionnaire data is that the vast majority of faculty are so open to the possibility of using information technologies.

Nevertheless, both the users and non-users of technology that participated in this study pointed to many serious shortcomings in current practice that hinder faculty use of technology. In the following sections this study examines factors at the college level and beyond which college faculty consider obstacles to their use of information technologies.

B. At the Institutional Level

When you look at a higher education issue from a national perspective, as this study does, there is a tendency to focus on problems that lend themselves to solutions on a national scale. In fact, this inquiry identified many educational software issues that, given appropriate attention, would be best addressed at a regional or national level.

However, when you ask faculty what they think are obstacles to more effective instructional use of information technologies, you hear a great deal about institutional problems that do not lend themselves at all to large-scale solutions. Some of the most challenging obstacles to expanded educational use of computers, video and audio are deeply imbedded in prevailing patterns at the colleges themselves. What follows is a discussion of some of the institutional obstacles identified by faculty in Phase III focus groups.

1. Existing Institutional Policies

Faculty who attempt to use electronic technologies in their classes are quick to point out how certain institutional policies hinder their efforts. Sometimes existing policies directly interfere with faculty efforts to use technology; in other cases the absence of supportive policies is to blame. Some of the most vehement comments came from technology users who complain that they are operating in a new academic world that is still governed by the rules of an old academic order.

Some faculty complain that existing budgetary practices make it difficult to obtain financial support for large investments in hardware and software. A common complaint among faculty is lack of funds for maintenance, repair and support of hardware within traditional budget categories. Many faculty also point to recordkeeping and pay practices that are based on traditional definitions of student-faculty contact-hours; they complain such practices penalize innovative faculty members.

Others noted that current policies regarding intellectual property rights at their institutions are oriented to print and are often inadequate to handle software materials developed by faculty members. The same is true of promotion and tenure practices which recognize research and publication but not development of software materials that improve teaching.

In spite of all the complaints about institutional policies that surfaced in the focus group discussions, a relatively small proportion of these faculty seem to feel that their institutional leaders are not committed to increasing technology use on their campus. Out of 15 items in the obstacles question, the mean scores for this item ranked it in the lower third. Only 45 percent, 39 percent and 36 percent agreed that lack of commitment by institutional leaders was a problem for computer, video and audio technologies, respectively.

2. Lack of Funds

Faculty comments during the discussion portions of the focus groups and their questionnaire responses left no doubt that they feel lack of funding is the greatest obstacle to the instructional use of information technologies in higher education. They see this as a more critical factor for computer technology than for video and audio technologies.

Of the 15 items in the obstacles question, the item about the "lack of institutional funds to adequately support institutional use of this technology" was ranked highest for all three technologies. Of the 173 respondents, 75 percent indicated lack of funding was an obstacle for computer technologies, 64 percent for video technologies and 56 percent for audio technologies.

With regard to computers, faculty indicated the problem is not just money for purchase of hardware and software. Meeting the day-to-day support needs for paper, diskettes, printer ribbons, security, maintenance and repair also pose significant financial obstacles to computer use. Many complained that the care and feeding of just a few microcomputers can decimate the annual budget of many academic departments.

Funding for equipment to playback existing video and audio software materials is less of a problem for faculty because the per-unit hardware costs are now so low. However, many faculty say the purchase and lease prices for video software materials are prohibitively high. This was less of an issue for faculty at institutions that participate in joint leasing arrangements with other institutions, but in some instances even these reduced charges pose an obstacle to use.

Faculty who are not content to merely use software materials developed by others complain about the lack of funds to support software development or adaptation. Many say their institution lacks sufficient funds to provide them with necessary video production facilities, instructional designers, computer programmers or compensation for their own time.

3. Lack of Access to Hardware

Equipment

Closely tied to the funding issue is the complaint by faculty that there is not enough equipment available on campus to support extensive instructional use of information technologies. One gets the feeling from listening to them that they feel they are disadvantaged compared to colleagues at wealthier institutions. Given current resource limitations and institutional priorities, they do not feel they or their students are likely to have access to enough equipment to make a substantial impact on the college's curriculum any time soon. For these faculty, the "information revolution" is interesting, but largely irrelevant to the day-to-day operation of their classes.

In response to the questionnaire item citing "lack of convenient access to hardware" as an obstacle to the instructional use of information technologies, 66 percent agreed this was a problem for computer technologies. The percentages for video and audio technologies were 60 and 43, respectively; it was ranked the second greatest obstacle of the 14. Faculty comments in the focus group discussions reinforced the importance of this issue.

Logistics

There is another side of the access issue that has little to do with money. When faculty consider potential applications of computers or interactive video in their classes, they often reflect on their previous experiences with technology in the classroom. These reflections can be sobering reminders of the gap that often exists between grand designs and day-to-day realities.

They relate "war stories" about logistical nightmares they have endured in past efforts to integrate technology into instruction. The examples include some of the following: pushing audio/visual carts between buildings in snowstorms, holding classes in buildings that are inaccessible to the technology they want to use, holding classes on evenings or weekends when there are no technical support staff to fix a problem, having the closed-circuit system or the time-sharing system fail during a classroom presentation, etc.

Turf

In addition to the financial and logistical aspects of the access issue, faculty point to organizational "turf" issues that also hinder instructional use of information technologies. Questions about which department has priority access to the computer lab or the interactive video or audio classroom can loom large when technical resources are scarce.

Security

Some focus group participants who have had considerable experience using technology for instruction pointed out another access issue that is easy to overlook. They described problems they have had attempting to prevent theft and breakage of computer, video and audio equipment. Unfortunately, some of the policies that help assure the security of the hardware (and software) can severely limit student access. For instance, learning needs can end up taking a back seat to security considerations when it comes time to schedule learning labs. This can be a particular problem for students whose personal schedules require them to study evenings and weekends.

Working Adults/Off-Campus Learners

Faculty point out that the security issue creates a particularly difficult access problem for one sector of the student population. Working adult students, whose personal schedules require them to do much of their learning on weekends or evenings (both on and off campus), are often seriously inconvenienced because access to computer, video or audio equipment is limited to times when the college is willing or able to provide security protection.

Information technologies can make it much more convenient for students to learn at a distance from the campus. But again, there are situations where student access to equipment on campus or in off-campus learning centers is constrained by security concerns. This is unfortunate, as there could be extensive off-campus use of microcomputers in community learning centers if security were not such a problem. Faculty complain that such obstacles discourage them from requiring students to use information technologies in their courses.

4. Lack of Sufficient Incentives and Rewards

Perhaps the most perplexing of all obstacles mentioned in the focus groups is the lack of sufficient incentives and rewards for faculty who want to make instructional use of computer, video and audio technologies. This problem varies at each institution depending on its commitment to the teaching process. But even at colleges and universities where there are explicit policies favoring teaching over research, faculty still maintain that the incentives or rewards available are in no way commensurate with the extra time required to integrate technology into their courses.

The importance faculty attach to this issue is apparent from their responses to the questionnaire item citing the "lack of sufficient incentives or rewards for using this technology to improve instruction" as a potential obstacle. Sixty (60) percent agreed this was an obstacle for computer technologies. The figures for video and audio technologies were 56 percent and 52 percent, respectively.

Most of the obstacles mentioned by faculty that relate to hardware and software issues probably could be overcome in a matter of a few years if adequate funds were available. Unfortunately, it is not as easy to solve the incentive and reward problem.

Incentives

When it comes to encouraging instructional applications of information technologies, colleges and universities have been more successful in devising incentives than rewards. Incentive efforts include some of the following: orientation, training, computer loan or gift programs, support from technical experts (e.g., instructional designers, programmers), peer support groups and mini-grants.

Rewards

Only a few focus-group participants indicated that technology-based instructional improvement efforts were considered favorably in promotion and tenure deliberations on their campus. Most faculty maintained that such efforts go unrewarded, and in some cases, even jeopardize career advancement by raising questions about the seriousness of the faculty member's commitment to research.

5. Lack of Conveniently Available Training

Focus group participants indicated they felt it was more of a problem to get convenient access to training in the use of computers than in either video or audio technologies. The percentages agreeing that this is an obstacle were 60, 47 and 38 for computer, video and audio, respectively.

It's worth pointing out that both the training and the incentive/reward issues are not exclusively institutional problems. Discipline-based professional associations and publications have the capacity to influence the kind of faculty behavior that is, through their constituents at the campus level, encouraged and rewarded. State agencies, national education associations and funding agencies also share some of the responsibility for encouraging teaching improvement activities. Such agencies are able to support campus-level efforts to improve the situation if their leadership decides to make the effort to do so.

6. Inadequate On-Campus Technical Assistance

In most of the focus-group discussions, faculty indicated they felt their on-campus instructional services staff did a satisfactory job of supporting their technology needs. However, they also made it clear that they felt more resources were required to meet the growing demand, stimulated largely by the growing proliferation of microcomputers at their institutions. The questionnaire data substantiates this impression: 52 percent agreed lack of technical assistance for computer technologies was an obstacle, while the figures for video and audio were 35 and 32, respectively.

7. Lack of Time

There was general agreement in the focus group discussions that instructional use of information technologies inevitably involves more, rather than less of the average faculty member's time. However, it is worth noting that some faculty reported their use of computers for their course recordkeeping had saved them considerable time.

Not only did faculty comment directly about the extra time it takes to integrate computer, video and audio technologies into their courses, but the issue was implicit in virtually everything that was said in the discussions. In one way or another, they were really talking about limits on their own time when they mentioned problems such as learning to use hardware and software; accessing hardware; obtaining technical assistance; locating, reviewing and evaluating software and obtaining incentives and rewards.

Responses to the two questionnaire items about faculty time tell us that faculty feel the time required to learn how to use computers is much more of an obstacle than the time it takes to use them for instruction on a day-by-day basis. These responses also tell us that faculty feel it takes more time to learn computer than video or audio technologies.

Obstacle	Percentage Agreeing		
	Computer	Video	Audio
The extensive amount of time required to learn how to use this technology for instruction	59%	20%	14%
Using this technology for instruction adds too much extra time to the faculty work week	36	28	23

C. Beyond the Institution

1. Technology as an Obstacle

Incompatibility

In the focus-group discussions, faculty directed some of their most ardent complaints at the technologies themselves. Lack of compatibility between hardware from different manufacturers, and in some cases from the same manufacturer, is a source of great frustration among educators.

The issue affects all information technologies, but faculty are most vocal about how hardware incompatibility prevents them from making more effective use of microcomputers. This lack of compatibility in the computer industry is exaserbated by the decentralized pattern of

microcomputer acquisition at most colleges. As a result, faculty often face the near impossible task of combining available software and a heterogeneous collection of hardware to achieve an educational objective.

Even though faculty appreciate the fact that we are in the early stages of the microcomputer's evolution, they feel there is much more that could be done by those in the computer industry to make it easier for educational organizations to use different computer makes and models. Focus group members pointed out that this problem is not limited to computers. Incompatibility between video formats (e.g., VHS vs. Beta, American vs. European) also complicates their efforts use whatever video material they may be able to locate.

Hardware and Software Impediments to Instruction

Many focus group participants commented on how all information technologies tend to get in the way of the learning process. They had particularly harsh things to say about microcomputers. They complained about the difficulties they and their students often encounter just getting past the initial start-up procedures so they can deal with the academic content. Even when such procedures go smoothly they often require so much time that some faculty are discouraged from using computer software in classroom demonstrations.

Classroom use of videotape and audiotape is also complicated whenever the faculty member wants to access images or sounds that are not in linear order on the tape. Faculty complain that searching for the appropriate tape frames in the middle of a classroom presentation can be very time consuming and distracting.

Limits on the size of available video and computer screens pose a major obstacle to classroom use for many faculty. Most large monitors and projection devices that make it possible for groups to view demonstrations are still much too expensive for most colleges to afford; supplying numerous classrooms with such devices is prohibitively expensive. Without substantial improvements in the quality and the price structure of such viewing devices, even the best educational software we can develop is unlikely to be seen in medium-size and large college classrooms.

2. Lack of High Quality Software Materials

Faculty are especially critical of the quality of computer software. Seventy (70) percent of the focus group participants agree that the "lack of high quality software materials in my academic area for this technology" is an obstacle to instructional use of computers. The corresponding figures for video and audio software materials are 47 and 40, respectively.

In the focus-group discussions there was a general consensus that as much as 90-95 percent of the available computer software for

college-level instruction was inferior in one way or another. Some of the faculty complaints about computer software included the following:

*too slow
*too elementary -- not enough upper-level software available
*too passive
*too many factual errors
*too "cute" -- efforts to be entertaining often fall flat
*too little learned for the amount of student time required
*too much print and not enough interesting visual material on computer screens
*too many small unrelated programs that do not support an entire course in a consistent manner
*lack of congruity with existing textbooks
*fail to take into account different cognitive levels and learning styles of students

Faculty were not uncritical of video software materials, but there were fewer complaints voiced. Complaints about nationally marketed video software materials included the following:

*too expensive
*too passive
*too inflexible in structure -- difficult or impossible to obtain single programs or segments
*copyright issues are too complex-- especially for in-class use of segments
*too superficial-- often avoid the more complex concepts and issues
*too much narration -- often leave too little room for students to draw their own conclusions about the visual images they see
*lack congruity with textbooks
*fail to fit into existing college curriculum

There were few comments made about audio software materials. Faculty in the fields of music and foreign languages expressed interest in obtaining specific kinds of audio software materials.

We should point out that not all comments about currently available software materials were negative. Judging from the generally positive tone of the responses to the 14 item question about reasons for using information technologies (refer to Table 15), faculty appreciate what good educational software materials can do. As a matter of fact, the intensity of many of the negative comments suggest that faculty are frustrated with available software materials because so much of it falls short of the high quality they feel could be attained.

Faculty know that software developers can produce excellent materials when there is enough financial incentive. They want software that exploits the strengths of the technologies.

3. Lack of Access to Descriptive and Evaluative Information About Software Materials

In every focus group faculty commented about how difficult it is to find out what software materials are available. Many indicated that they have spent considerable time searching catalogs, advertisements, reviews and vendor booths at professional meetings; they report the results rarely justify the time invested. They wonder why there are not more efficient information dissemination mechanisms in place.

Faculty not only want to find out what software materials are available. They are even more interested in knowing how good they are. They report finding very few sources of evaluative information; what information exists often does not tell them everything they feel they need to know in order to make an intelligent acquisition decision.

Most indicated that they find materials offered by vendors (e.g., brochures, demo tapes and demo disks) provided an inadequate basis for making decisions about whether to acquire software materials. They complain that most software developers and/or marketers allow them to review only a small portion of the entire software package; in some cases no review materials are available.

Faculty say that if they cannot review the complete software package themselves, they at least want to read evaluations by colleagues who have used the software in a teaching situation. Multiple evaluations of the same software is preferred. Some also indicated an interest in reading student evaluations.

Judging from their comments in the discussions and their responses to questionnaire items, the problem of finding out about available software is more of a problem for computers than it is for video or audio technologies. The questionnaire responses summarized below suggest faculty feel that lack of opportunities to review software is even more of an obstacle than the lack of either descriptive or evaluative information.

Obstacle	Percent Agreeing		
	Computer	Video	Audio
Lack of access to information about what software materials are available in my academic area for this technology	58%	47%	42%
Lack of evaluative information about the quality of software available for this technology	60	49	45
Insufficient opportunities to review software materials prior to deciding to use them	66	53	45

4. Legal and Financial Complications of Recording or Copying Software Materials

Numerous focus group participants mentioned that current copyright policies regarding software materials interfere in their efforts to use information technologies in their courses. They report that merely finding out what the copyright provisions are for a given software package can consume considerable time and energy.

Once they find out what the copying or recording restrictions are, faculty often conclude that it is not cost-effective to acquire the software. With computers, the reason may be that they need too many copies of the software. In the case of video, they may find they cannot use it for enough semesters to justify the cost. This is particularly a problem for faculty who only want to use segments of a video telecourse or video program to supplement their lectures. The bottom line is that they get discouraged by the high costs and the copyright complexities.

With regard to computer and video technologies, over fifty (50) percent of the focus group participants agreed that these issues are obstacles . The figures are 55 percent for computer, 51 percent for video and 42 percent for audio.

5. Policies of State Education Agencies

Some faculty pointed out that state education agency policies can also hinder the integration of information technologies into the curriculum. For example, the way some state agencies define student contact hours discourages faculty from making innovative use of information technologies. Why figure out ways to give students more individualized learning experiences if faculty are remunerated on the basis of time spent in the classroom?

V. FACULTY SUGGESTIONS FOR IMPROVING INSTRUCTIONAL USE OF INFORMATION TECHNOLOGIES

In the Phase III focus-group discussions, faculty were given the opportunity to share their views about computer, video and audio technologies. They spent much of that time describing ways in which current practice falls short of meeting their instructional needs. However, when asked how things could be improved, they responded with numerous suggestions.

Most of the suggestions they made dealt with instructional software and were directed to people involved in designing, developing, marketing and funding such materials. Some of the suggestions were rather ambitious and would require national, regional or state-wide improvement efforts. Others were modest ideas that could be implemented with little effort. A few of the suggestions dealt explicitly with actions their own colleges could take; others were implicit in complaints about current institutional practices.

A. Suggested Improvements in Instructional Software Materials

1. Instructional Software Clearinghouse

Focus-group participants often suggested there should be some form of a national or regional clearinghouse serving as a central resource center for faculty with questions about instructional software. Some faculty seemed to think there was a more critical need for such a service in the computer software area, but it was clear from the discussions that most faculty would welcome the opportunity to access information about computer, video and audio software materials from a single source.

Some of the services faculty said they would like such a resource center to provide include the following:

- *Descriptions of available software-- including level of difficulty, prerequisite skills, hardware requirements, copyright provisions, accompanying print materials, costs, etc.
- *Faculty evaluations of software-- preferably written by faculty who have used it with students
- *Student evaluations of software

Whether this information was made available in a print or electronic form did not seem to matter to the focus group participants.

2. Instructional Software Needs Assessments

Numerous faculty suggested that there was a need for discipline-based or cross-disciplinary groups to conduct systematic assessments of instructional software needs. They proposed that there should be procedures for finding out what software materials are needed by faculty in math, psychology, physics or art.

They attributed many of the current mismatches between available software and faculty instructional needs to the lack of adequate communication between teachers and software developers. Some focus group participants predicted that this problem would not get better unless groups of their colleagues were brought together to identify specific courses, course-segments and concepts that need special attention.

They seem to feel that decisions about what software materials get developed are made by small groups of people who are too far removed from the classroom. They recommend more grass-roots input to correct the situation. These faculty are not unaware that software companies and textbook publishers have groups of academicians advising them about what to develop. Their point was that current procedures are not sufficiently broad-based to yield products that meet the needs of most college teachers.

Instructional Bottlenecks

A number of focus-group participants advocated using the needs-assessment strategy to identify "instructional bottlenecks" that software developers should concentrate on. They maintain that in every field there are certain concepts, relationships or procedures that most students have difficulty mastering and most faculty would like help conveying.

Why not bring together groups of faculty from the same field and charge them with the task of identifying some of the most troublesome instructional bottlenecks? Then ask them to propose pedagogical strategies for overcoming each problem. If it seems appropriate to use technology to address the problem, then the group should suggest ways software developers might proceed.

Faculty who advocated focusing on these bottlenecks indicated that they would be very pleased to have at their disposal a series of computer and/or video modules to use as part of their classroom presentations or by individual students. They stressed the need for a relatively consistent series of such aids that are designed to accompany a particular course (e.g., Introductory Physics). This strategy is consistent with the often-expressed preference for software materials that can supplement the instructor by doing things he or she cannot do as easily or as well.

3. Flexible Software

When faculty describe the kind of instructional software they would like to have there seems to be a built-in tension between two concepts-- structure and flexibility. On the one hand, they want to exercise as much control as possible over any instructional resource they use. Yet most do not like to think they have to become computer programmers or video producers to use the software materials.

On the other hand, faculty appreciate the advantages of having software materials developed by experts who are supported by substantial financial resources. The reason they most often give for turning to technology-based software is to provide students with experiences they cannot easily provide themselves.

What most of the focus-group faculty seem to want in the way of software is something that provides them with a basic structure that sets some broad parameters. Within that structure they want as much flexibility as possible to determine exactly the kind of learning experience the student has.

In the computer area, authoring languages have been developed as tools to help educators meet such objectives. However, very few of the faculty even mentioned authoring languages in the focus group discussions. Apparently there is plenty of room for new and improved approaches to helping faculty obtain the mix of structure and flexibility they say they want from instructional software.

Video Modules

In non-interactive video (e.g., broadcast TV, one-way cable TV, videotape) there are limits to how much flexibility the software developer can provide. Structuring a video course or program so it can be divided into many smaller modules seems to be one way of accommodating faculty demands for flexibility. Many focus-group participants indicated they prefer to see video structured this way because it is easier to integrate into classroom presentations; it also facilitates individualized learning for students outside the classroom.

Generic Computer Programs

Another indication of faculty preference for flexibility within an overall structure can be found in their comments about the use of generic computer programs that are applicable across several disciplines. Many faculty involved in this study indicated they used word processing, speadsheet or data-base management programs in their courses.

Faculty appreciate the fact that they can adapt these applications programs to a particular academic field or course with little or no programming knowledge. They liked the idea that it is possible to develop or acquire "templates" that adapt commercially developed applications packages to specific academic purposes. Their comments made it clear that they would like to have access to more generic applications programs and templates, indicating that one advantage of using such a combination is that, unlike many computer programs developed by their academic colleagues, most commercially developed software is well documented and well supported.

Some faculty wondered why the idea of generic applications programs could not be applied even more directly to the needs of higher education instruction. Since many academic fields deal with complex relationships that can be more easily understood and appreciated when students participate in a simulation, why shouldn't someone develop generic simulation packages?

For example, one videotape presentation to faculty from the social sciences, humanities and fine arts included a simulation of life in 17th century France. It was suggested that a generic history simulation with a similar structure be developed for use by faculty at various institutions. These faculty could then adapt it to specific time periods, locations and sets of conditions.

Another suggestion was that a generic simulation program for science laboratory experiments could be developed that would allow the faculty user to select specific lab equipment and procedures in order to tailor the experiment to the needs of his or her specific course.

Focus-group participants knew of simulations that have been developed to deal with specific circumstances. The problem they described with such simulations is that they usually cannot be adapted to reflect the teaching preferences of the individual faculty user. Other fields that lend themselves to the development of generic simulation programs include business, economics, politics, medicine, allied health, psychology, sociology, and all the sciences.

Random Access to Video Images

It was clear from their comments that today's faculty are more focused on computer than on video technologies. There are many obvious reasons for this given current developments in the microcomputer field.

Nevertheless, when they talk about the types of learning resources they would like information technologies to make available, visual images are high on the list of priorities. Although computer graphics are increasingly able to provide the visual data faculty want, there are a number of reasons why faculty want access to images that are best conveyed by video. For one thing, many excellent instructional resources that faculty want to access already exist on video, and many others will follow. Another reason not to forsake video entirely in favor of computer graphics is that much of the visual information that faculty want to communicate to their students involves images of specific people, events, places, historical periods and physical and biological phenomena.

Although they did not always state it in these terms, what most faculty who participated in this study indicate they want is random (or very convenient) access to visual data. The technology that is best able to provide this capability is the laser videodisc. It can provide faculty and students with instantaneous access to a multitude of single frames or full-motion segments. When combined with the microcomputer, the videodisc offers faculty the opportunity to tailor classroom and individualized instruction to their particular preferences.

One suggestion that emerged from the focus-group discussions was to use the videodisc to solve the "instructional bottleneck" problem mentioned earlier in this section. Faculty would like to have various ways of instantaneously accessing instructional materials focused on common instructional bottlenecks that are known to give students difficulty in a particular course.

They suggested that one way of implementing this idea would be to gather groups of colleagues from each discipline to identify instructional bottlenecks in introductory and upper-level courses. Then academic or commercial organizations would involve some of the participants in developing print and electronic instructional materials that use the combined strengths of laser discs and microcomputers.

Faculty users of such packages could design their own computer software to tailor the materials, or they could select pre-packaged software designed to address the subject matter from various perspectives. Someone also suggested that it should be possible for faculty users to add their own audio component to accompany the video images on the videodisc. Even if it is not yet possible for faculty videodisc users to imprint their own audio onto one of the audio tracks of an educational disc, it should be possible to link an audiotape or audiodisc device to the videodisc via the microcomputer. Such an arrangement, if uncomplicated and moderately priced, could provide faculty with a mixture of structure and flexibility that many would find very appealing.

Focus-group participants who are familiar with microcomputer and videodisc technology pointed out that such a scenario would not be practical until there is a low-cost educational workstation on the market that combines these technologies. Estimates of what price-level such a workstations would have to reach in order to meet the needs of both manufacturers and educators ranged from $1000 to $3000.

4. Textbook-Related Improvements

In response to a request for suggested improvements in instructional use of information technologies, many faculty pointed to the textbook as an important component in any instructional delivery system. They also suggested there are many important lessons to be learned about the instructional process by observing how faculty use textbooks.

Since most college faculty are more than willing to tell their students and colleagues how much they disagree with "this perspective" or "that definition" found in the textbooks they use, it is surprising to hear them talk in almost reverentially about the virtues of textbooks compared to information technology software. In the focus groups, they pointed out that textbooks are designed and developed with a level of rigor they find lacking in most software. They also stress that the textbooks contain both visual and textual material that can be accessed randomly by both faculty and students.

Given that one of the most common faculty complaints about current practice is the failure to satisfactorily integrate software materials with textbooks, it was not surprising to hear many suggestions about the need to coordinate the development of software materials and textbooks from the earliest design stages. Participants in the study stressed such integration is necessary for all technologies, but most of their suggestions for improvement involved computer software.

Many focus-group members had seen or heard of examples of computer software being marketed along with textbooks. It was their impression that in most of these cases the computer software was merely added on as an afterthought to enhance book sales. They preferred to see accompanying computer exercises carefully integrated with individual chapters or major content areas of the textbook: simulations, data bases, drill and practice, quizes and tests were among the suggestions offered.

5. Faculty Handbooks

To improve the fit between faculty instructional needs and technology-based software it was suggested that self-improvement resources, like handbooks,be developed for faculty who want to learn more about how to integrate information technologies into their courses. Whether in a print or electronic form, or both, such materials could help faculty identify and analyze their instructional problems. The materials could also describe alternative approaches to integrating electronic technologies into courses. Information on the advantages and disadvantages of different technologies could also be included.

6. General Advice to Software Developers

Participants in the study made several suggestions on the subject of improving educational software materials. Many of their comments have been incorporated into the above sections. Other more general suggestions intended for software developers are included below. Faculty suggest software developers should do the following:

*Emphasize quality over quantity when deciding how to spend software development resources. It is better to have less software of high quality than a wider selection of lower quality products from which to choose.

*Develop more software that focuses specifically on helping students develop generic skills like problem-solving, decision-making, and analyzing. Too much of the software is focused on transferring of course content information.

*Design more software for use with small groups of students. Too much current software is intended for use with large groups of students or for individual learners; it fails to exploit the dynamics of peer interaction and the realities of limited hardware availability.

*Some video software materials could be improved by designing them to be stopped at certain intervals to have students respond to questions in workbooks, small groups or classes. This would help overcome the passivity that non-interactive video tends to engender.

*Software needs to be labeled more accurately as to the level of difficulty of the material

*Software materials should include information that would that could help the instructor match it with different student learning styles.

B. Suggested Improvements for Colleges and Universities

Participants in the faculty focus groups made many comments containing either explicit or implicit suggestions about how to increase the effectiveness of technology-based software materials at their institutions. Some of these suggestions include the following:

*Establish an on-campus clearinghouse or information exchange to inventory existing software so that faculty can find out what is available and which colleagues they might like to talk with.

*Establish an institution-wide policy regarding intellectual property rights for faculty who develop software materials for sale beyond the institution.

*Budget more funds for the acquisition and maintenance of hardware and software to support instruction; support personnel to provide technical assistance to faculty are also greatly needed (hardware technicians, instructional designers, computer programmers, etc.).

*Establish policies that increase access to computer, video and audio instructional resources for the average faculty member and student (e.g., wiring the campus, establishing more learning labs on campus)

*Provide more opportunities for faculty to learn how to use computer, video and audio technologies for instruction (e.g., on-campus training, off-campus seminars, conferences)

*Initiate policies at the institution and academic department levels that encourage and reward instructional use of information technologies by faculty

VI. OBSERVATIONS

A. Faculty Attitudes Toward Information Technologies

After reviewing the questionnaire data and listening to college faculty this researcher is left with some general impressions. They include the following:

1. Faculty generally feel positive about the potential of information technologies to improve the effectiveness of higher education instruction.

2. Faculty are extremely critical of the quality of most currently available software materials (this is particularly true of computer software).

3. Faculty are more intensely interested in computers than in video or audio technologies: this intensity is reflected in both their positive and negative comments.

4. Faculty highly value video technology for the types of images it can convey and for the extensive amount of material already available in a video format.

5. For many faculty, information technologies are an interesting, but largely irrelevant, part of the campus scene; obstacles to the use of these technologies (e.g., lack of access to hardware, inadequate software, lack of incentives, lack of training, lack of technical and logistical support, etc.) make it impractical for many of them to be involved at this time.

6. Faculty see the role of information technologies as supplemental to their own instruction; as resources to extend their ability to convey course content, not as replacements for functions they already perform well on their own or with textbooks.

7. Most faculty prefer software that has enough structure to preclude the need for them to become computer programmers or video producers -- yet flexible enough for ready adaptation to their courses, according to their own personal preferences.

8. Of all the faculty characteristics examined in this study, the most helpful in accounting for differences in responses was the one measuring extent of technology use.

9. Faculty who make greater use of information technologies in their courses are less concerned about the lack of training opportunities, the lack of software information, the lack of incentives and rewards, and the lack of access to hardware than are their colleagues who make moderate or no use of these technologies; heavy users are more concerned than are their colleagues about inadequate on-campus technical assistance and software copyright restrictions.

10. Information technologies often indirectly stimulate more faculty interest in teaching improvement activities than do many of the more direct faculty development strategies.

B. The Higher Education/Information Technology Marketplace

After listening to faculty talk about the kinds of instructional software materials they would like to have at their disposal, it is difficult to escape the conclusion that higher education is an unusual sector of the American economy. In particular, the information technology portion of the higher education marketplace is most unique.

In comparison with the business community or for that matter, the K-12 education community, higher education seems relatively small, very decentralized and highly specialized. Add to these structural traits the strong personal preferences most college and university faculty have regarding what and how to teach and you have a situation that is enough to discourage some of the most ardent entrepreneurs.

If you owned a business that developed technology-based software materials and were looking for potential markets to serve, you probably would view higher education with some skepticism. It is the type of market that seems most likely to reward commercial or academic organizations with a heavy commitment to higher education and to faculty involvement in all phases of software development.

There is clearly a lack of congruity between the technology-based software materials faculty say they need in order to address their instructional problems and the software materials that are currently available from commercial and academic sources. However, it seems unlikely that normal market mechanisms will overcome this situation in the near future.

Currently there are not enough incentives for software developers to adequately assess and meet the software needs of college faculty. Unless the higher education community devises incentives for commercial and academic software developers to create the kinds of software faculty say they want, we are unlikely to see rapid improvement in the current situation. Those who value the potential contribution information technologies can bring to higher education should consider what can be done to insure that market conditions alone do not determine long-term developments in this area.

Many of the recommendations contained in this report are based on the assumption that higher education is a unique marketplace. A marketplace that, in some cases, requires its own tailor-made solutions to the problems of supply and demand if the best interests of the colleges, faculty and students are to be served.

C. Support Services for Faculty

One of the messages that comes through loud and clear from the participants in this study is the importance of providing faculty with

support services. Access to hardware is, without a doubt, one of the highest priorities; but focus-group participants left no doubt that in order for them to make effective use of computer, video and audio technologies they must have support. Rewards and incentives are the most valued forms of support, but faculty also want access to training and technical expertise (programmers, instructional designers, technicians to operate, maintain and repair hardware, etc.).

We live at a time when much is written in the popular and educational press about hardware issues (e.g., new products, institutional acquisition of equipment, industry/education joint development projects, etc.). It is all too easy to overlook the initial and long-term support needs of the faculty and student users of all this technological hardware. The faculty participants in this study left no doubt about the importance they attach to these support issues.

D. Video Software Materials

The comments of classroom faculty suggest that there are some fundamental problems that limit the educational usefulness of much of the nationally marketed video software. Many of these materials fail to fulfill their instructional potential. This is sometimes because of their academic content, but more often it is because of the format and the conditions under which they are distributed.

In general, the problems have to do with confusion caused by overlapping agendas. All too often public broadcasters and educators try to make the same video series serve the needs of two or more of the following audiences:

*General public broadcasting audiences
*Students learning in a distance-learning mode (e.g. video telecourse students)
*Students learning in classroom settings on college campuses

In theory it is perfectly logical that segments or even entire programs might succeed in satisfying the needs and preferences of all three of these audiences. In fact it is rare when an entire series can do so.

One problem concerns educational content. In developing a video course there is the problem of providing enough depth to meet the college instructor's expectations for academic rigor while keeping the program content general enough to maintain the interest of the public broadcast viewer. Faculty participating in the study indicated they would be more inclined to use video programs for instructional purposes if they went into a little more depth on important concepts.

The other problem is a copyright and marketing issue rather than a substantive issue. The study found that faculty prefer software materials that are sufficiently flexible in structure as to be easily

integrated into their courses. Unfortunately, faculty who want to use segments of video series (telecourses or prime-time public broadcast programs) to supplement their in-class lectures are discouraged from doing so for a couple reasons.

First, their institution has to pay the cost of acquiring the audio/visual rights. Unless it has multiple uses for the series in question (e.g., many faculty using the same series in their courses during the same term and/or use of the series as part of a distance learning program) it is very difficult to justify the cost of acquiring the audio/visual rights for one course.

Another problem concerns the format in which video series are marketed. Unless the copyright provisions for a series have been designed to permit colleges to acquire individual segments or modules without acquiring the entire series (a practice that is increasing but still the exception), it is generally impractical for a college to pay the cost of acquiring an entire course so that an individual faculty member can use selected portions.

For institutions that have a substantial distance learning program in which many students view video materials over broadcast and/or cable television and also have access to the videotapes in learning centers, it is generally cost-effective to acquire broadcast and audio/visual rights for specific courses. At such institutions, faculty who want to use portions of these courses in their on-campus classes can do so. However, if they want to use portions of other courses not acquired by the college they face the same situation described above.

Since most four-year private colleges and universities are less likely to have a substantial distance learning program, the current copyright and marketing practices are particularly disadvantageous. The problem also prevails for faculty at public institutions with either small distance learning programs or none at all.

The current situation works against the best interests of both the colleges and the agencies that produce and market the educational video series. Faculty are frustrated because they cannot easily get access to video resources they feel can enhance their courses. Likewise, producers who presumably would like to expand their markets beyond the relatively small number of institutions with distance learning programs are losing out on potential income.

It may be that the changes in design, packaging, marketing and copyright provisions required to improve this situation are not cost-effective for agencies that produce educational video materials. However, after talking to the college faculty who participated in this study, there seem to be some good educational and financial reasons for reexamining current practices.

E. Collaborative Improvement Projects

Many of the current obstacles to effective use of computer, video and audio technologies in higher education are unlikely to be overcome without significant collaborative efforts involving colleges, educational associations, software developers and hardware vendors. Without support and leadership from educational foundations and funding agencies, many of these needed collaborations are unlikely to take place because they require the involvement of so many diverse constituencies. Some potential collaborative efforts are described in the recommendations to funding agencies found in section VII of this report.

VII. RECOMMENDATIONS

A. College and University Administrators

Most college and university administrators find themselves spending an increasing proportion of their time dealing with information technology issues. Because of the large capital expenditures that are often involved, it is easy for them to get absorbed in all the hardware issues (e.g., Whether, when and what to buy?). Many of these administrators must be tempted to expend all available technology funds on equipment acquisition in the face of all the competing requests for equipment from constituencies within the institution.

Faculty participants in this study left no doubt that they feel support services for faculty and students are at least as essential as important as the hardware. Most of the following recommendations focus on actions that, if taken, would support faculty in their efforts to make effective instructional use of the hardware.

1. Institutional Planning

Most administrators will not be surprised to learn that the faculty in this study rarely suggested that their administrators initiate a strategic planning process at their institution. However, many faculty comments and suggestions did focus on the need for clear institutional policies regarding the role of information technologies in instruction, research and administration. Faculty see many of the incongruities between current policies and policies that will be needed in order to effectively integrate computer, video and audio technologies into the institution. They feel they should be active participants in any efforts to resolve these incongruities.

2. Institution Information Exchange

Numerous faculty commented on the need for a place on campus where they can find out what software materials are in use at the institution. They also want to identify colleagues who might be able to help them in their efforts to use, adapt or develop software for their courses.

It seems advisable for institutions that do not yet have such an information center to consider establishing one. Depending on the size of the institution it may be advisable to decentralize such activities into different academic areas (e.g. social sciences) or colleges. Other academic support services such as training and software acquisition might also be compatible with the information center function. In the long-run it would be advantageous for such a center to maintain information on computer, video and audio technologies together rather than separately.

3. Departmental Information Technology Representatives

Assigning a faculty member in each department to serve as an information technology representative, or "guru," is another strategy for

supporting faculty efforts to integrate software materials into their courses. Ideally such individuals should have experience or training in the use of one or more of the technologies. However, even if they only serve as the focal point for information about institutional and discipline-oriented technology resources, they can have a substantial impact on their colleagues. In addition to their departmental role, these representatives can also serve as resource persons for institutional training and software acquisition activities.

4. Incentives and Rewards

The study revealed that one of major obstacles to effective use of information technologies is the lack of incentives or rewards for faculty who make the effort to improve their instruction. This situation is unlikely to change without vigorous support from top institutional leaders.

This is particularly true for promotion and tenure criteria. Without professional recognition for their teaching improvement efforts, faculty have little reason to invest the time required to use, adapt or develop software materials.

One way of encouraging faculty is to set up a competitive mini-grant program that offers them modest amounts of money and/or release time for their teaching improvement efforts. By supporting well-designed faculty proposals to use information technologies, it may be possible to substantially increase the quantity and quality of faculty technology use.

5. Budget and Finance

Faculty who were more active users of information technologies pointed out that traditional budgeting and finance practices often interfere in their efforts to use information technologies. Institutional leaders who wish to encourage more faculty use of computer, video and audio technologies need to consider making realistic adjustments in budgeting and finance procedures to address this issue.

Procedures are required to deal with large front-end investments in hardware and software that may be obsolete in 2-5 years. Realistic provisions also must be made for activities such as maintenance (e.g., diskettes, paper, ribbons, tape, servicing), repair (in-house or contract-out), housing (e.g., rooms for computer labs, video studios, etc.), local and long-distance networking, consortium memberships, training and retraining academic and technical staff, etc.

In some cases new policies and procedures must be developed to solve the special problems raised by the use of information technologies. In other cases, it may be possible to redistribute existing funds and/or acquire additional funds.

6. Intellectual Property Rights

As more faculty get involved in adapting or developing instructional software materials, institutions will need to examine their policies regarding intellectual property rights to determine whether they are appropriate for software as well as print materials. This issue is most critical for colleges and universities that plan to encourage faculty to develop software for marketing to colleagues at other institutions.

7. Collaborative Activities

"Lack of institutional funds to adequately support the use of technology" was rated as the greatest obstacle to the use of information technologies by faculty in this study. Because of the high costs of using information technologies, colleges and universities are well advised to collaborate in order to share resources whenever possible. Institutions that choose to go it alone are likely to put themselves at a serious competitive disadvantage.

Some of the most common reasons for collaborating with other institutions include the following: software needs assessment, software development and acquisition, networking, faculty and staff training, library and data-base access, distribution of instruction (via satellite, microwave, cable), access to large computers, etc.

B. Faculty

1. Realistic Expectations

This report describes what some may describe as "a faculty wish-list." Part of the purpose of the study was to elicit suggestions for improvements in current practice, not to constrain creativity. Therefore, it should not be surprising if some of the faculty suggestions contained in these pages are not implemented.

The study draws attention to many aspects of the higher education/information technology marketplace that distinguish it from other markets, such as business and pre-collegiate education. College faculty need to temper their software and hardware expectations with the knowledge that they are in a relatively small, decentralized and specialized market that is unlikely to ever be as well served as other larger, more attractive markets.

2. Active Consumers

Unless faculty and their institutional leadership play an active role in helping higher education compensate for its limited appeal in the commercial marketplace, we are unlikely to see more than incremental improvements in the current situation. Faculty need to find more effective ways to communicate their instructional needs to commercial and academic software producers. They also need to become better informed, more aggressive consumers. Institutions and faculty cannot afford to pay the price of being passive consumers under such market conditions.

Faculty also need to urge their institutions to take actions that can lead to concrete improvements. Examples of such actions are described in the recommendations to administrators, funding agencies and software developers that appear in this chapter.

3. Professional Development

Faculty also would be well advised to realize that, when it comes to information technologies, they probably need to take more responsibility for their own professional development than they have in the past. The impact information technologies are having on the society at large are so great that it may become increasingly difficult to make the case that the primary responsibility for faculty development in this area lies with the colleges and the foundations.

Professionals in all walks of life are finding they have to invest time and effort to adjust to the fundamental changes in the ways our society is now able to gather, organize and distribute information. Many of these professionals, including a significant minority of college faculty, are making such investments -- regardless of whether the organizations they work for underwrite them.

4. Information Technologies and Instructional Problems

Just as it is important for faculty not to overlook the contributions information technologies can make to their courses, it is also important that they not assume these technologies will automatically solve all their instructional problems. It is advisable to first carefully assess the instructional problem and then look for solutions; information technologies should be considered among a wide range of potential instructional tools.

Although it may seem logical to start out by asking, "What can I do with computers in my course?" or "How can I use video to motivate student interest?", this approach is likely to lead to more problems than it solves. In this case it would be more appropriate to find out why students are not motivated or why they are having difficulty with certain concepts or procedures before assuming technology is the solution. At a time when there is so much emphasis on technology in the society at large, it is important that faculty to keep technology in proper perspective-- as a tool for solving instructional problems, not as <u>the</u> solution.

C. Educational Policymakers and Funding Agencies

The study's findings suggest a number of activities that could improve teaching and learning in higher education. Some of the needed improvements are likely to take place even if policymakers and funding agencies take no action; in such cases progress will merely be slower and less systematic than it might have been with foundation support. However, other needed developments are unlikely to occur at all unless strong policy makers and funding organizations concerned with improving higher education take the initiative, establishing services and generating

cooperation among diverse constituencies. Many of the improvements that need support and encouragement from policymakers and funding agencies can be loosely categorized as strategies to compensate for current inadequacies in the higher education/information technology marketplace.

In a healthy, mature marketplace one would expect to find a high level of correspondence between demand and supply, plus adequate feedback devices to insure that the producers kept pace with changes in consumer needs. In contrast, the higher education/information technology marketplace is in early stages of evolution and will require considerable nurturing to operate efficiently. There are many existing entities-- both commercial and academic-- that need to learn more about each other; they also need to learn how to work together more closely to achieve goals that are in their mutual interest. There is also the need to create new mechanisms to provide services neither producers nor consumers are likely to establish on their own. This situation is complicated by the fact that college faculty are not only users (consumers), but also adaptors and producers of educational software.

Some activities that may require support and encouragement from policymakers and funding agencies are briefly described below.

1. Software Information Clearinghouse(s)

Many faculty who participated in the study could not understand why there is no central source for descriptive and evaluative information about software materials. They complain that the information that is available is unsystematic and incomplete.

There can be little doubt that the need for such a service exists. At this point it is still unclear whether it would be best to establish a single national clearinghouse or numerous regional or discipline-oriented centers. It also is not clear whether such a service should include information about computer, video and audio software materials or merely concentrate on computers, where the shortfall is most acute. Should such a service be electronic or print-based, or both?

There is also the question of whether such a service is potentially self-supporting. Educators are unusually generous about sharing information, but all too often they are unwilling to pay for the real costs of gathering, analyzing and disseminating information. However, in the case of information technologies, the substantial hardware investments colleges already have made may lead them to subscribe to such a service.

Perhaps the most important question is which organization(s) should undertake the responsibility for delivering such services. It may be necessary to create a new organization specifically for this purpose if a collaborative effort proves unworkable. Up to now no organization has taken on the task of providing descriptive and evaluative information on all software for any single technology, let alone for all three. Judging from the comments of faculty involved in this study, whatever information has been collected has obviously not been adequately disseminated.

Some organizations that have taken steps to address at least some aspects of this problem include the following: For computers -- The Guttman Library at Harvard University, Minnesota Educational Computing Consortium, CONDUIT, EDUCOM, North Carolina State University (in the social sciences). For video -- The American Association for Higher Education, and the Western Interstate Commission on Higher Education, the Adult Learning Programming Service of the Public Broadcasting Service among others.

Some commercial publications include descriptions of computer software, but unfortunately most faculty seem to be unaware of them. Some examples include Data Decisions, Software Digest, Software Reviews on File, plus various specialized software directories. In addition, The Chronicle of Higher Education, T.H.E. Journal and some discipline-based academic journals publish computer software descriptions.

The magnitude of the task and the large number of interested constituencies probably account for the lack of progress to date on this problem. Policymakers and funding agencies could make a major contribution to higher education by convening interested parties to search for a course of action that would address the obstacles described by faculty.

Perhaps a central on-line data base containing descriptive information on computer, video and audio software from the sources listed above would be the logical first step. The more difficult problem of providing evaluative information may need to be addressed after such a system is established. As the amount of software materials expands, this problem can only become worse unless action is taken.

2. Encouraging the Development of Academic Computer Software

There is another related problem that is also unlikely to be adequately resolved without the support and encouragement of policymakers and funding agencies interested in the welfare of higher education. The proliferation of microcomputers on college campuses has stimulated the development of a growing body of academic software. Faculty members operating alone and in teams (including computer programmers, instructional designers, graphic artists, etc.), are producing software for their own use; some of this software is available to colleagues at other institutions for fees generally far below commercial rates and in some cases merely for the cost of a diskette.

Most of the computer software examples included in the two Phase III focus group videotapes were developed by faculty rather than commercial companies. Faculty participants in the study seem positively disposed to using high quality software developed by colleagues who are familiar with teaching problems in their field; they also definitely prefer the lower prices.

Due to the peculiar characteristics of the higher education market, commercial software companies are unlikely to meet many of the more specialized computer software needs of faculty. In order to encourage the development and distribution of academic software (produced by faculty), special mechanisms may well be needed.

In a well reasoned article on academic computer software in the Summer 1985 EDUCOM Bulletin, Steven W. Gilbert describes how the creation of three new organizations or programs could contribute to the evolution of a more coherent and effective academic software market in higher education. They include the following:

*Academic Software Development Information Exchange

Similar in many respects to the clearinghouse concept discussed above, the exchange would use descriptions of available computer software to help software developers build on each other's efforts and avoid unnecessary duplication. It would be primarily oriented to encouraging non-commercial software development by faculty.

*Academic Software Delivery Service

This service would be low-cost delivery mechanism to facilitate distribution of academic software and provide faculty developers with a modest return to cover development costs. Such a service would make it easier for colleges and universities to acquire the quantity and quality of software they need to more effectively integrate computers into their curricula. North Carolina State University already provides some of these services for faculty in the social sciences.

*Academic Software Agency

Such an organization would serve as a knowledgeable broker between faculty who can develop commercially viable software and commercial software companies that are willing and able to support the development and marketing of appropriate educational software.

It is unlikely that much progress will be made toward the creation of such services without support from educational policymakers and funders. Support would be particularly critical during the initial stages of development in order to bring together the relevant constituencies to consider alternative solutions to the problems.

3. Instructional Software Feedback Mechanisms

Faculty participants in the study indicated there was too little communication between the developers of computer, video and audio software and faculty who are the end-users/adaptors. Two of the strategies suggested for dealing with this problem could be combined or employed separately; they would probably require start-up support from foundations or commercial software developers.

Faculty suggested that one way of overcoming the incongruity between the software they want and the software that is currently available would be for one or more organizations to conduct systematic assessments of what faculty consider their most pressing software needs.

Some faculty suggested such needs assessments should be conducted within each discipline on either a national or regional basis.

Among those supporting such a concept, some advocated focusing on instructional bottlenecks that students commonly encounter in specific courses. Others advocated merely identifying entire courses that need software materials.

Another way of improving communication between the software developers (commercial or academic) and the faculty (users and adaptors) would be to establish an ongoing feedback mechanism. Resource people could periodically demonstrate new and developmental software to groups of faculty at numerous institutions around the country. Faculty critiques of the software could be used to improve it and help developers avoid some of the problems faculty currently complain about. Both software developers and faculty stand to benefit from the outcomes of such a feedback process.

4. Generic Computer Applications Software

Many faculty participants indicated they prefer using generic, or general purpose applications software because, in addition to being easily adapted, it is generally well-designed and well-supported. These comments seem to reflect a national trend in this direction.**

In the focus groups faculty mentioned numerous advantages to using generic software. Chief among these was its flexibility; applications software offers faculty the opportunity to adapt powerful tools to the specific needs of their courses. Faculty also appreciate the fact that there is a large commercial market for word processors, spreadsheets, data-base managers, problem-solvers, etc.; they generally feel this means the quality will be high and it will be supported.

Faculty in some focus groups suggested there is also a need for generic software that specifically addresses educational needs (e.g., simulations, time-line programs, problem-solving programs, etc.). However, without encouragement from educational funding sources, there is no assurance that generic software will be developed specifically for educational purposes. Unless such programs have applicability in fields other than higher education, commercial software companies may not be motivated to develop them. It may be necessary to support academic software developers in order to get such efforts underway.

** Data from the 1985 Higher Education Utilization Study (published by the Corporation for Public Broadcasting) indicates that instructional use of general purpose applications software is the fastest growing use of computers among both faculty and students. Preliminary Draft, September 1985, Tables 19 and 20.

5. Teaching Improvement

Over the years many projects and programs have been devised to encourage faculty to improve the effectiveness of their teaching. Some of these programs have met with success, but all too often, the stimulus for change has evaporated at the end of the program.

This study found that many faculty see a strong connection between overall teaching effectiveness and the use of information technologies. Perhaps funding agencies should consider supporting faculty use of information technologies as an indirect strategy to stimulate improved teaching. One advantage of relying on technology as the stimulus for change is that there is every reason to believe computer, video and audio technologies will continue to be a vital force within higher education for the foreseeable future.

6. Incentives and Rewards

Regardless of the contributions information technologies may make to teaching or research with the academy, the incentive and reward system is slow to respond to the expanding presence of electronic media in higher education. The findings of this study testify to this fact.

Inevitably this situation will improve. However, in the meantime, without support and encouragement from policymakers and funding agencies, many opportunities for improving teaching are likely to go unrealized due to a lack of incentives and rewards.

Some strategies that seem to warrant special consideration by policymakers and funding organizations include the following:

a. Encourage budgetary and financal practices that enable colleges and universities to respond to the growing demands for hardware, software and support services.

b. Revise state funding formulas to encourage alternative formats for delivering instruction via information technologies both on and off campus.

c. Revise personnel practices to encourage faculty to use information technologies and other means to improve the effectiveness of their teaching.

d. Encourage policies regarding intellectual property rights that encourage faculty to develop instructional software for the higher education marketplace.

e. Encourage discipline-based professional associations to recognize their members' efforts to integrate technology-based software into instruction in their publications and at their regional and national meetings.

f. Encourage faculty to learn how to use, adapt or develop instructional software by supporting mini-grant programs at colleges and universities; preference should probably be given to institutions that demonstrate a willingness to emphasize teaching improvement in their promotion and tenure practices.

g. Support faculty training in the use, adaptation and development of instructional software; smaller institutions in isolated communities should be given special attention because they and their communities often lack the technical expertise to make much progress in this area on their own.

D. Software Developers

1. Upper-Division Courses

Faculty complain that most of the available software is appropriate for lower-division courses and therefore of limited use for upper-division and graduate instruction. Both commercial and academic software developers should focus more attention on these areas if they hope to see more thorough integration of their products into the curriculum.

Since most upper-division courses serve fewer students and usually involve more complex concepts, it may be more realistic to expect academic software developers to help fill this void. Commercial developers may never venture heavily into such specialized academic areas because of the limited prospects for profits.

Judging from comments made in the focus groups, faculty who teach upper-division courses are most interested in flexible software and generic computer software tools that they can easily adapt to fit their courses. They prefer video and audio software materials that are packaged in highly flexible formats.

2. Software Previewing Opportunities

Faculty commented that they do not have adequate opportunities to preview software materials before committing funds to acquire them. Few computer software developers seem to be providing faculty with demonstration disks; those that do often provide too little information about the software. Similarly, faculty rarely have the opportunity to view all the video and print materials prior to teaching a video course.

The previewing problem involves many logistical, copyright and cost issues that make it a difficult one to solve to everyone's satisfaction. Nevertheless, software developers will have to devise more convenient preview procedures if they hope to increase faculty use of their products.

3. Needs Assessment and Feedback

It was apparent from faculty comments that they feel software developers need to communicate more effectively with faculty before, during and after software materials are developed. To the extent they can, software developers should expand their efforts to involve a representative range of faculty in identifying software needs and in providing feedback on software as it is developed.

4. Combining Technologies

As software developers consider how to proceed in higher education, they should take every opportunity to explore ways of combining computer, video and audio technologies. Faculty respond very positively to the idea of having convenient (rapid and/or random) access to visual and aural information. Judging from the apparent direction of technological advances and the stated preferences of faculty it is important that software developers look beyond their own separate technologies.

5. Generic Computer Software

Generic computer programs offer faculty a mix of structure and flexibility that many find attractive. Whether such software is originally designed for the business community or the higher education community, it still seems to appeal to faculty members' as a tool they can adapt to their own particular courses and teaching styles. Powerful, but very user-friendly, authoring languages may also help provide faculty with the mix of structure and flexibility they prefer. This area deserves much more attention from both commercial and academic software developers.

6. Expanding Use of Video Software

The results of this study suggest that developers of video software should take steps to increase the likelihood that faculty will use their materials for instruction. They need to reconsider the wisdom of trying to serve multiple audiences (general public broadcast viewers, distance learners, and on-campus learners) with the same video programs. If they decide to continue serving all three audiences, they will have to incorporate more flexible features into the design and distribution of the programs so that faculty will be able to use them for on-campus classes.

Faculty participants in the study say they want to use video segments as vignettes to supplement their class presentations and as modules for student use outside class. If it was less expensive and less complicated for faculty to gain access to selected portions of a video series, there would likely be increased on-campus use of video software materials. More modular instructional designs and more accessible audio/visual rights are two actions that would greatly improve the current situation

7. Textbook/Software Combinations

The comments of faculty who participated in this study suggest that software developers would be well-advised to explore ways of building on existing faculty acceptance of the textbook. Developers need to examine more closely the features faculty say they like about textbooks as well as the way they actually use textbooks. Both software developers and textbook publishers need to experiment with more effective ways to integrate technology-based software with textbooks. They also need to learn more about how to design textbooks that fit into an increasingly technological academic environment.

E. Discipline-Based Professional Associations

There are a number of actions disciplinary professional assocations could take to respond to the needs of their technology-using members. Many of these actions are also likely to encourage improved teaching practices among members who have yet to incorporate information technologies into their courses. One way of influencing the incentive and reward systems at the campus and departmental levels would be to provide national recognition and services from national, discipline-based associations. Some examples include the following:

1. Publications

One of the easiest and potentially most helpful steps professional associations can take is to publish informative reviews of relevant software materials in their publications. Likewise, encouraging the submission of articles by members who have developed, adapted or used software materials is a way to recognize and give legitimacy to faculty who are concerned with the improvement of teaching practices.

2. Needs Assessments

Discipline-based professional associations should be involved in efforts to identify entire courses and/or instructional bottlenecks that could benefit from the availability of new instructional resources. What are the most common instructional problems, and what might be the best approach to solving them? Could technology-based software materials be used to help solve the problems?

3. Meetings and Services

In addition to doing more to integrate information technolgies into their publications, professional associations could also use their national and regional meetings to focus more attention on information technology issues. They could also establish print and electronic vehicles to encourage communication among members dealing with similar academic content and technology issues (electronic mail, bulletin boards, data bases, teleconferences, etc.)

F. Hardware Vendors

If hardware vendors are interested in expanding the use of information technologies in higher education they should focus attention of some of the following problems:

*Developing common operating systems or software that can operate easily on various computer systems

*Developing a low-cost computer work-station that provides faculty with rapid and/or random access to video and audio information

*Developing affordable monitors and projection devices that are capable of communicating computer and video images large enough to be seen in medium-sized and large classrooms

G. Conclusion

This is a time when many educators, policymakers, funders and business people are looking for ways to improve the quality of higher education. This study describes some of the ways computer, video and audio technologies can contribute to improving the effectiveness of college faculty. It also highlights many problems that need to be addressed if higher education is to fully benefit from these new educational resources.

There is little doubt that information technologies are here to stay. The major question is whether the various constituencies that care about the quality of higher education in this country will take some of the steps necessary to assure that electronic technologies are a force for improvement rather than a source of additional problems. Hopefully the faculty perspectives described in this study will prove useful to those who seek to encourage improvement in higher education instruction.

PHASE II FOCUS GROUP TABLES

Table 1 PHASE II INSTITUTIONS AND FACULTY RESPONDENTS

Institution*	State	Faculty Respondents Number	Percent
Northern Illinois University	IL	10	12
University of Rhode Island	RI	20	25
University of South Florida	FL	13	16
Bunker Hill Community College	MA	4	5
Clayton Junior College	GA	10	12
Laney College (community college)	CA	16	20
Vista College (community college)	CA	8	10
		81	100

*Plans called for the inclusion of a private university but the focus group was cancelled at the last minute.

Table 2 PHASE II FACULTY RESPONDENTS BY ACADEMIC AREA

Academic Area	Number	Percent
Social Science	14	17
Humanities/Fine Arts	20	25
Science	10	12
Engineering, Computer Science, Math	12	15
Business	6	7
Other	19	24
	81	100

PHASE III FOCUS GROUP TABLES

Table 3 PHASE III INSTITUTIONS AND FACULTY RESPONDENTS

Institution	State	Faculty Respondents Number	Percent
Minneapolis Community College	MN	39	23
Macalester College	MN	17	10
University of Nebraska-Lincoln	NE	21	12
University of Nebraska-Omaha	NE	24	14
SUNY College at Buffalo	NY	29	17
Syracuse University	NY	17	10
Lane Community College	OR	10	5
Lewis and Clark College	OR	16	9
		173	100

Phase III Focus Group Tables (con't)

Table 4 PHASE III INSTITUTIONAL CATAGORIES

Institution Type	Number	Percent
Two-Year Public	49	29
Four-Year Public	72	42
Four-Year Private	50	29

Table 5 PHASE III FACULTY RESPONDENTS BY ACADEMIC AREA

Academic Area	Number	Percent
Social Sciences	30	17
Humanities	55	32
Fine Arts	11	6
Sciences	40	23
Math, Computer Science, Engineering	22	13
Business	9	5
Other	6	4
	173	100

Table 6 FACULTY RESPONDENTS BY YEARS OF COLLEGE TEACHING

Faculty Years of College Teaching	Number	Percent
0- 5	25	15
6-10	34	20
11-15	31	18
16-20	41	24
21-25	28	16
26+	12	7
No Response	2	1
	173	100

Table 7 FACULTY RESPONDENTS BY ACADEMIC RANK

Academic Rank	Number	Percent
Instructor	39	23
Assistant Professor	32	19
Associate Professor	39	23
Full Professor	43	25
Other	15	9
No Response	5	3
	173	100

Table 8 FACULTY RESPONDENTS BY TEACHING STATUS

Faculty Status This Term	Number	Percent
Full-Time	154	89
Part-Time	11	6
Other	5	3
No Response	3	1
	173	100

Table 9 FACULTY RESPONDENTS BY TECHNOLOGY USE**

	Non-User		Moderate User		Heavy Us	
	N	%	N	%	N	%
Computer	57	33	53	31	62	3
Video	42	24	85	49	45	2
Audio	79	46	61	36	32	1
No Response	1					

(N = Number of Respondents; % = Percentage)

Table 10 INSTITUTION TYPE BY TECHNOLOGY USE

		Technology Use		
	Number	Non User	Moderate User	Heavy User
Computer				
Two-Year Public	49	35%	27%	38%
Four-Year Public	74	35	32	33
Four-Year Private	50	26	34	40
Video				
Two-Year Public	49	15	56	29
Four-Year Public	74	24	51	25
Four-Year Private	50	36	42	22
Audio				
Two-Year Public	49	33	50	17
Four-Year Public	74	47	33	19
Four-Year Private	50	58	24	18

**The figures in this table were arrived at by combining the response to questions 8 and 9 on the Phase III questionnaire. For information on the method for deriving the combined score, refer to Appendix D. This technology use data is used in tables 10-14.

Table 11

ACADEMIC AREA
BY TECHNOLOGY USE

		Technology Use		
Computer	Number	Non User	Moderate User	Heavy User
Social Science	30	30%	33%	37%
Humanities	55	49	33	18
Fine Arts	11	55	18	27
Science	40	23	40	38
Math, Computer Science	21	10	6	76
Business	9	33	22	44
Other	5	20	40	40
No Response	2			

Video	Number	Non User	Moderate User	Heavy User
Social Science	30	33%	40%	27%
Humanities	55	15	49	36
Fine Arts	11	18	46	36
Science	40	23	63	15
Math, Computer Science	21	52	43	5
Business	9	11	44	44
Other	5	20	40	40
No Response	2			

Audio	Number	Non User	Moderate User	Heavy User
Social Science	30	57%	27%	17%
Humanities	55	24	46	31
Fine Arts	11	27	36	36
Science	40	58	33	10
Math, Computer Science	21	76	19	5
Business	9	33	56	11
Other	5	60	40	0
No Response	2			

Table 12

YEARS OF TEACHING
BY TECHNOLOGY USE

		Technology Use		
	Number	Non User	Moderate User	Heavy User
Computer				
0-10	58	31%	29%	40%
11-20	72	38	25	38
20+	40	25	45	30
No Response	3			
Video				
0-10	58	28	47	26
11-20	72	19	46	35
20+	40	28	63	10
No Response	3			
Audio				
1-10	58	55	24	21
11-20	72	36	39	25
20+	40	50	45	5
No Response	3			

Table 13 ACADEMIC RANK BY TECHNOLOGY USE

	Number	Technology Use: Non User	Moderate User	Heavy User
Computer				
Instructor	39	41%	23%	36%
Assistant Professor	32	47	19	34
Associate Professor	39	23	41	36
Full Professor	43	28	35	37
Other	14	21	43	36
Video				
Instructor	39	15%	49%	36%
Assistant Professor	32	28	47	25
Associate Professor	39	31	54	15
Full Professor	43	23	47	30
Other	14	21	57	21
Audio				
Instructor	39	26%	44%	31%
Assistant Professor	32	56	31	13
Associate Professor	39	49	33	18
Full Professor	43	51	33	16
Other	14	50	36	14

Table 14 FORMAL TECHNOLOGY TRAINING BY TECHNOLOGY USE

	Number	Technology Use: Non User	Moderate User	Heavy User
Formal Training				
Computer	47	23%	34%	43%
Video	14	7	50	43
Audio	23	26	22	52
No Formal Training				
Computer	83	36	33	31
Video	83	31	49	19
Audio	83	52	36	12
No Response	6			

Table 15 REASONS FOR USING INFORMATION TECHNOLOGIES

Reasons	Technology	SD	D	A	SA	?	Mean	Rank C	Rank V	Rank A
To increase my effectiveness as a teacher.	C	1%	5%	45%	41%	9%	3.05	1	3	2
	V	1	4	42	40	14	2.93			
	A	2	7	36	32	23	2.50			
To help motivate students to be more interested in the content of the course.	C	2	9	46	33	10	2.89	6	2	3
	V	2	6	47	35	10	2.89			
	A	4	10	44	23	20	2.45			
To help students develop specific abilities (e.g., problem-solving analysis, writing, visualizing, etc.).	C	1	6	40	43	10	3.04	2	7	6
	V	2	9	45	27	17	2.63			
	A	2	10	41	21	27	2.27			
To help students learn important concepts or skills that are particularly difficult to master.	C	1	12	42	42	9	2.97	3	5	4
	V	2	12	42	42	14	2.74			
	A	3	16	38	23	21	2.36			
To help convey relationships between abstract concepts and concrete experiences.	C	2	9	41	38	11	2.93	5	4	8
	V	1	6	45	33	15	2.80			
	A	3	12	37	21	26	2.24			
To encourage students to be more active learners.	C	2	9	42	38	9	2.97	4	8	9
	V	5	14	41	25	16	2.53			
	A	5	15	36	19	25	2.20			
To enable students to experience real-world problems in a safe, manageable or cost-effective manner (e.g., simulations, experiments).	C	2	8	42	32	16	2.72	9	11	11
	V	1	11	41	24	23	2.41			
	A	4	15	38	16	28	2.09			
To make it easier to deal with differences in the learning styles and abilities of students in the same class.	C	1	15	36	31	17	2.63	10	10	10
	V	1	15	41	24	20	2.47			
	A	2	19	33	20	27	2.18			

Table 15
Page 2

Reasons	Technology	SD	D	A	SA	?	Mean	Rank C	Rank V	Rank A
To help students appreciate times, places, people and events that cannot be experienced in a conventional classroom.	C	4%	17%	35%	30%	15%	2.61	11	1	1
	V	1	6	34	47	13	3.01			
	A	2	9	34	32	23	2.52			
To reduce the need for me to use class time to repeat basic course content information.	C	3	21	39	28	8	2.75	8	6	7
	V	3	22	38	27	10	2.67			
	A	3	23	33	20	21	2.26			
To deliver instruction to students in off-campus settings (e.g., home, workplace, learning centers).	C	4	19	37	21	20	2.35	12	9	5
	V	4	16	35	27	19	2.48			
	A	5	14	35	23	23	2.28			
To help me manage my courses (grading, recordkeeping, assessment, diagnosis).	C	5	17	34	36	8	2.87	7	14	13
	V	14	29	21	15	22	1.19			
	A	15	28	20	13	24	1.81			
To increase opportunities for student-faculty interaction.	C	5	32	33	11	19	2.12	14	12	12
	V	5	32	31	11	21	2.04			
	A	6	32	24	10	27	1.84			
To respond to students' expectations that this technology should be used in college-level courses.	C	9	28	32	13	17	2.16	13	13	14
	V	10	29	28	10	23	1.93			
	A	12	32	23	9	26	1.76			

Total Population = 173
C=Computer; V=Video; A=Audio
SD=Strongly Disagree; D=Disagree; A=Agree; SA=Strongly Agree; ?=Uncertain

Table 16 OBSTACLES TO INSTRUCTIONAL USE OF INFORMATION TECHNOLOGIES

Obstacle	Technology	SD	D	A	SA	?	Mean	Rank C	Rank V	Rank A
Lack of institutional funds to adequately support instructional use of this technology.	C	1%	10%	32%	43%	13%	2.90	1	1	1
	V	4	16	30	34	17	2.59			
	A	4	16	26	30	24	2.34			
Lack of convenient access to hardware (e.g., computers, videotape players, audio conferencing equipment).	C	6	27	35	31	1	2.88	2	2	3
	V	9	34	26	24	7	2.50			
	A	10	32	25	17	16	2.19			
Lack of high quality software materials available in my academic area for this technology.	C	6	15	34	36	9	2.82	3	5	9
	V	8	30	31	17	16	2.25			
	A	6	27	25	15	28	1.93			
Lack of sufficient incentives or rewards for using this technology to improve instruction.	C	6	29	38	22	5	2.65	4	3	2
	V	7	27	37	19	10	2.46			
	A	6	26	35	17	16	2.29			
Insufficient opportunities to review software materials prior to deciding to use them.	C	3	20	41	25	12	2.64	5	5	6
	V	4	24	36	17	20	2.25			
	A	5	22	32	13	28	1.98			
Lack of conveniently available training for faculty in the instructional use of this technology.	C	12	23	42	18	5	2.55	8	5	4
	V	16	30	38	9	8	2.25			
	A	17	32	32	7	12	2.04			
The extensive amount of time required to learn how to use this technology for instruction.	C	12	25	38	21	5	2.58	6	14	14
	V	25	47	16	4	8	1.82			
	A	31	41	12	2	15	1.57			
Lack of access to information about what software materials are available in my academic area for this technology.	C	12	24	34	24	6	2.57	7	7	5
	V	8	28	30	17	17	2.23			
	A	8	27	28	14	24	2.01			

Table 16
Page 2

Obstacle	Technology	SD	D	A	SA	?	Mean	Rank C	Rank V	Rank A
Lack of evaluative information about the quality of software available for this technology.	C	8%	18%	43%	17%	14%	2.41	9	9	7
	V	8	22	39	11	20	2.13			
	A	8	21	35	10	25	1.97			
Inadequate on-campus technical assistance to help faculty with hardware or software problems.	C	9	30	35	16	9	2.39	10	10	10
	V	12	41	25	10	13	2.06			
	A	13	36	24	9	19	1.90			
The legal and financial complications of recording or copying software materials for student and faculty use.	C	6	19	32	23	19	2.34	11	8	8
	V	5	23	32	19	22	2.19			
	A	6	24	28	14	28	1.93			
Inadequate integration of the print (manuals, student guides, texts, etc.) and the electronic components of software materials.	C	2	17	39	17	25	2.22	12	12	12
	V	2	21	35	12	30	1.97			
	A	2	21	31	10	36	1.78			
Lack of commitment by institutional leadership to increasing the use of this technology.	C	9	45	24	11	12	2.13	13	11	12
	V	6	39	27	8	19	1.98			
	A	7	36	23	8	27	1.78			
Using this technology for instruction adds too much extra time to the faculty work week.	C	16	39	17	6	23	1.68			
	V	17	41	20	8	15	1.87			
	A	16	39	17	6	23	1.68			
My own concerns about the long-term negative impact of this technology on higher education.	C	47	38	9	4	2	1.65	15	15	15
	V	43	40	5	4	8	1.52			
	A	43	39	6	1	12	1.42			

Total Population = 173
C=Computer; V=Video; A=Audio
SD=Strongly Disagree; D=Disagree; A=Agree; SA=Strongly Agree; ?=Uncertain

75

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Table 17

REASONS FOR USING INFORMATION TECHNOLOGIES:
PERCENTAGE OF AGREEMENT BY LEVEL OF TECHNOLOGY USE

Reasons	Technology**	Total Population	Non User	Moderate User	Heavy User
To increase my effectiveness as a teacher.	C*	85	72%	87%	95%
	V*	81	62	81	100
	A*	67	54	71	94
To help motivate students to be more interested in the content of the course.	C	79	72	81	84
	V*	82	55	88	96
	A*	67	48	82	85
To help students develop specific abilities (e.g., problem-solving analysis, writing, visualizing, etc.).	C*	83	70	85	92
	V*	72	57	71	89
	A*	62	51	64	85
To help students learn important concepts or skills that are particularly difficult to master.	C	79	74	76	87
	V*	73	67	71	84
	A*	61	52	59	85
To help convey relationships between abstract concepts and concrete experiences.	C*	79	60	87	89
	V*	78	64	78	91
	A*	58	49	61	75
To encourage students to be more active learners.	C	80	69	87	86
	V*	66	45	64	89
	A*	55	44	56	84
To enable students to experience real-world problems in a safe, manageable or cost-effective manner (e.g., simulations, experiments).	C	74	67	74	81
	V	65	55	64	76
	A	54	44	61	63

Table 17
Page 2

Reasons	Technology**	Total Population	Non User	Moderate User	Heavy User
To make it easier to deal with differences in the learning styles and abilities of students in the same class.	C*	67	60%	85%	60%
	V*	64	55	72	58
	A*	53	39	66	63
To help students appreciate times, places, people and events that cannot be experienced in a conventional classroom.	C	65	60	68	67
	V	81	81	75	91
	A	66	58	72	75
To reduce the need for me to use class time to repeat basic course content information.	C	67	68	72	63
	V*	65	52	64	77
	A*	52	44	51	75
To deliver instruction to students in off-campus settings (e.g., home, workplace, learning centers).	C	58	60	57	57
	V	62	50	64	69
	A	58	54	62	56
To help me manage my courses (grading, recordkeeping, assessment, diagnosis).	C	70	60	72	79
	V	35	31	35	38
	A	32	29	28	47
To increase opportunities for student-faculty interaction.	C	44	35	51	47
	V	42	24	39	64
	A	35	27	41	44
To respond to students' expectations that this technology should be used in college-level courses.	C	46	44	51	44
	V*	38	19	38	59
	A	31	20	39	44

*Statistically significant difference between groups
**C = Computer, V = Video, A = Audio

Table 18 OBSTACLES TO THE USE OF INFORMATION TECHNOLOGIES: PERCENTAGE OF AGREEMENT BY LEVEL OF TECHNOLOGY USE

Obstacle	Technology**	Total Population	Non User	Moderate User	Heavy User
Lack of institutional funds to adequately support instructional use of this technology.	C	75	72%	83%	71%
	V*	63	64	59	71
	A*	56	51	54	72
Lack of convenient access to hardware (e.g., computers, videotape players, audio conferencing equipment).	C	66	70	76	55
	V*	50	52	55	38
	A*	43	43	39	50
Lack of high quality software materials available in my academic area for this technology.	C*	70	77	74	60
	V	47	57	40	51
	A*	40	51	31	28
Lack of sufficient incentives or rewards for using this technology to improve instruction.	C	60	65	66	50
	V	55	48	62	49
	A	51	46	56	56
Insufficient opportunities to review software materials prior to deciding to use them.	C	66	63	70	65
	V	52	41	54	60
	A	45	44	44	50
Lack of conveniently available training for faculty in the instructional use of this technology.	C	60	67	64	50
	V	47	50	47	42
	A	38	37	44	31
The extensive amount of time required to learn how to use this technology for instruction.	C	59	60	64	53
	V	20	12	26	21
	A	15	14	20	6
Lack of access to information about what software materials are available in my academic area for this technology.	C	58	61	62	51
	V*	48	60	46	40
	A	42	46	44	31

Table 18
Page 2

Obstacle	Technology	Total Population	Non User	Moderate User	Heavy User
Lack of evaluative information about the quality of software available for this technology.	C	61	58%	68%	57%
	V*	51	52	51	49
	A*	46	42	49	50
Inadequate on-campus technical assistance to help faculty with hardware or software problems.	C	51	51	45	57
	V*	34	33	33	38
	A*	32	29	28	47
The legal and financial complications of recording or copying software materials for student and faculty use.	C	55	47	56	61
	V*	50	45	46	62
	A	41	37	39	56
Inadequate integration of the print (manuals, student guides, texts, etc.) and the electronic components of software materials.	C	56	47	60	61
	V*	47	50	47	42
	A	41	41	39	47
Lack of commitment by institutional leadership to increasing the use of this technology.	C	35	37	28	39
	V	36	38	31	42
	A	31	33	25	38
Using this technology for instruction adds too much extra time to the faculty work week.	C	37	39	40	32
	V	27	24	32	22
	A	23	23	21	28
My own concerns about the long-term negative impact of this technology on higher education.	C	13	19	15	5
	V	9	10	11	4
	A	7	9	7	3

*Statistically significant differences between groups.
**C = Computer; V = Video; A = Audio.

Table 19

REASONS FOR THE USE OF INFORMATION TECHNOLOGY
BY ACADEMIC AREA

Reasons	Tech	SSci Hum Arts Sci Math Bus	SSci	Hum	Arts	Sci	Math Eng	Bus
(N=Number of Respondents)		N=96	N=30	N=55	N=11	N=40	N=22	N=9
To increase my effectiveness as a teacher.	C*	78%	80%	78%	73%	93%	96%	89%
	V	83	77	86	82	83	73	78
	A	74	70	78	64	60	55	56
To help motivate students to be more interested in the content of the course.	C	78	77	78	82	75	91	78
	V	87	87	86	91	83	64	78
	A*	72	73	73	64	68	41	67
To help students develop specific abilities (e.g., problem-solving analysis, writing, visualizing, etc.).	C	79	80	78	82	85	91	89
	V	76	67	80	82	68	59	78
	A	69	57	75	73	55	46	56
To help students learn important concepts or skills that are particularly difficult to master.	C*	73	67	73	91	85	82	100
	V*	75	70	76	82	78	55	67
	A*	66	63	66	73	60	41	44
To help convey relationships between abstract concepts and concrete experiences.	C	73	63	78	73	80	96	89
	V	81	77	84	82	83	64	67
	A	62	63	66	36	60	46	44
To encourage students to be more active learners.	C	75	70	78	73	85	86	78
	V*	72	63	78	64	58	46	67
	A*	63	57	67	55	45	41	44
To enable students to experience real-world problems in a safe, manageable or cost-effective manner (e.g., simulations, experiments).	C*	66	67	67	55	78	91	89
	V	68	70	69	55	55	59	67
	A	56	57	60	36	43	50	56
To make it easier to deal with differences in the learning styles and abilities of students in the same class.	C	66	50	73	73	75	73	44
	V	65	50	73	64	60	64	67
	A	57	40	67	55	43	50	56

Table 19
Page 2

Reasons	Tech	SSci Hum Arts N=96	Sci Math Bus N=71	SSci N=30	Hum N=55	Arts N=11	Sci N=40	Math Eng N=22	Bus N=9
(N=Number of Respondents)									
To help students appreciate times, places, people and events that cannot be experienced in a conventional classroom.	C	67	61	70	67	55	53	77	56
	V	83	76	83	86	73	78	77	67
	A*	71	58	70	76	46	65	50	44
To reduce the need for me to use class time to repeat basic course content information.	C	63	72	50	67	73	65	77	89
	V*	65	62	57	66	82	55	73	67
	A*	54	48	53	55	55	48	50	44
To deliver instruction to students in off-campus settings (e.g., home, workplace, learning centers).	C	55	61	53	56	55	53	77	56
	V	64	58	57	67	64	50	68	67
	A	57	56	53	62	46	53	59	67
To help me manage my courses (grading, recordkeeping, assessment, diagnosis).	C	68	73	67	71	55	73	73	78
	V	37	31	30	42	27	28	36	33
	A	34	28	30	40	18	25	32	33
To increase opportunities for student-faculty interaction.	C	41	45	30	49	27	45	36	67
	V	46	32	33	53	46	33	23	56
	A	37	27	30	42	27	28	18	44
To respond to students' expectations that this technology should be used in college-level courses.	C	48	42	30	62	27	40	32	78
	V*	46	28	30	58	27	30	9	67
	A*	39	21	27	51	9	23	9	44

C=Computer; V=Video; A=Audio
*Statistically significant difference between groups

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Table 20

OBSTACLES TO THE USE OF INFORMATION TECHNOLOGY
BY ACADEMIC AREA

Obstacles	Tech	SSci Hum Arts Sci Math Bus	SSci	Hum	Arts	Sci	Math Eng	Bus
(N=Number of Respondents)		N=96	N=30	N=55	N=11	N=40	N=22	N=9
Lack of institutional funds to adequately support instructional use of this technology.	C	77%	73%	82%	64%	70%	73%	78%
	V	66	60	73	46	53	59	67
	A	57	50	64	46	55	55	44
Lack of convenient access to hardware (e.g., computers, videotape players, audio conferencing equipment).	C	70	60	75	73	63	59	44
	V	70	37	55	36	55	50	44
	A	39	37	42	27	48	50	44
Lack of high quality software materials available in my academic area for this technology.	C	72	67	75	73	75	59	44
	V	43	37	46	46	53	64	22
	A*	37	37	35	46	48	41	33
Lack of sufficient incentives or rewards for using this technology to improve instruction.	C*	62	80	56	36	65	46	56
	V	58	77	51	46	53	46	56
	A	54	73	47	36	48	41	56
Insufficient opportunities to review software materials prior to deciding to use them.	C	69	73	67	64	63	64	44
	V	53	57	55	36	50	55	33
	A	49	53	47	46	43	41	22
Lack of conveniently available training for faculty in the instructional use of this technology.	C*	65	57	66	82	58	50	33
	V	50	37	53	73	40	50	22
	A	39	33	40	46	35	46	22
The extensive amount of time required to learn how to use this technology for instruction.	C	62	67	60	55	60	41	56
	V*	25	23	26	27	15	5	11
	A*	18	17	22	0	13	5	0
Lack of access to information about what software materials are available in my academic area for this technology.	C	65	60	64	82	60	36	44
	V	49	47	51	46	45	50	33
	A	46	47	46	46	43	36	22
Lack of evaluative information about the quality of software available for this technology.	C	59	53	64	55	65	50	56
	V	51	40	60	36	53	41	44
	A	49	40	56	36	43	36	44

Table 20
Page 2

Obstacle	Tech	SSci Hum Arts	Sci Math Bus	SSci	Hum	Arts	Sci	Math Eng	Bus
(N=Number of Respondents)		N=96	N=71	N=30	N=55	N=11	N=40	N=22	N=9
Inadequate on-campus technical assistance to help faculty with hardware or software problems.	C	53%	48%	63%	47%	55%	48%	46%	56%
	V	34	34	30	36	36	33	32	44
	A	30	34	27	31	36	33	32	44
The legal and financial complications of recording or copying software materials for student and faculty use.	C	52	56	50	55	46	50	59	78
	V	48	49	40	55	36	48	55	44
	A	44	35	40	49	27	38	32	33
Inadequate integration of the print (manuals, student guides, texts, etc.) and the electronic components of software materials.	C*	49	66	50	47	55	70	64	56
	V*	40	55	37	40	46	58	59	33
	A	35	49	30	38	27	50	55	33
Lack of commitment by institutional leadership to increasing the use of this technology.	C	33	37	47	26	36	35	41	33
	V	35	35	40	33	36	35	32	44
	A	30	33	37	26	36	30	32	44
Using this technology for instruction adds too much extra time to the faculty work week.	C	35	41	33	36	36	50	27	33
	V	27	30	23	31	18	38	27	0
	A*	21	28	20	24	9	38	23	0
My own concerns about the long-term negative impact of this technology on higher education.	C	16	10	20	15	9	13	5	11
	V	9	7	13	9	0	10	5	0
	A	8	6	13	7	0	8	5	0

C=Computer; V=Video; A=Audio
*Statistically significant difference between groups

APPENDIX A

PHASE II QUESTIONNAIRE

INSTRUCTIONAL PROBLEMS FACING COLLEGE FACULTY

The following list of instructional problems encountered by college faculty is derived from the literature of higher education and interviews with faculty members. We are interested in your reactions to this list.

1) Please indicate the extent to which you agree or disagree that each of the items listed is a problem you have encountered in your teaching by circling the appropriate response. If you can think of other instructional problems that are not included below, please add them at the end of the list and score them in the same manner.

SA= strongly agree
A= agree
D= disagree
SD= strongly disagree

2) Please indicate which are the five most troublesome problems for you by rank ordering them (1= most troublesome) on the right side of this list.

Institution_____ Academic discipline(s)_____

1. Gaining access to informational materials necessary to support instruction (e.g., print, illustrations, data)	SA	A	D	SD
2. Assessing individual student differences in learning abilities, learning styles and developmental stages	SA	A	D	SD
3. Devising instructional strategies that respond to individual student differences	SA	A	D	SD
4. Teaching a class of students that includes a wide variety of learning abilities and learning styles	SA	A	D	SD
5. Finding a common frame of reference with students that facilitates communication and learning (e.g., people, events, or ideas that students recognize)	SA	A	D	SD
6. Motivating students to learn in structured settings (e.g., classrooms, labs)	SA	A	D	SD
7. Motivating students to learn in unstructured settings (e.g., home, libraries)	SA	A	D	SD
8. Engaging students in active modes of learning (e.g., question-asking, dialogue with other students, team-learning)	SA	A	D	SD
9. Conveying factual information	SA	A	D	SD
10. Conveying abstract concepts	SA	A	D	SD
11. Conveying relationships between theory and practice (e.g., getting students to apply theoretical concepts to concrete experiences)	SA	A	D	SD
12. Teaching students to reason inductively (e.g.,proceeding from discrete facts to generalizations or theories)	SA	A	D	SD
13. Encouraging students to extend their learning beyond traditional disciplinary boundries	SA	A	D	SD
14. Overcoming student resistance to learning approaches that vary from the traditional, didactic, lecture-based approaches	SA	A	D	SD
15. Conveying an appreciation for times, places and events that cannot be experienced in the current learning environment (e.g., other cultures, historical events)	SA	A	D	SD
16. Enabling students to experience real world problems in a safe, manageable and cost-effective manner (e.g. laboratories, simulations)	SA	A	D	SD
17. Encouraging the development of specific abilities (e.g., problem-solving, analysis, writing, listening, visualizing, social interaction)	SA	A	D	SD
18. Evaluating learning outcomes (e.g., skills, knowledge)	SA	A	D	SD
19. Managing the administrative logistics of instruction (e.g., grading, record keeping)	SA	A	D	SD
20. Achieving more effective teaching without vast expenditures of faculty time	SA	A	D	SD
21. Obtaining professional rewards for making efforts to teach more effectively	SA	A	D	SD
_____	SA	A	D	SD
_____				
_____	SA	A	D	SD
_____				
_____	SA	A	D	SD

APPENDIX B

PHASE III QUESTIONNAIRE

Learning and Technology Services
Integrating information technologies into education and training
P O Box 30207
Portland, Oregon
97230
(503) 256-4187

CPB PROJECT FACULTY QUESTIONNAIRE

R___
I___
T___
D___

Professional Background - Please circle or fill in the appropriate response.

1. Institution:_____

2. Academic discipline: _____

3. Academic department to which you belong: _____

4. Number of years (including this one) you have taught at colleges and universities: 1. 0-5 3. 11-15 5. 21-25
   2. 6-10 4. 16-20 6. 26+

5. Academic rank at this institution:
   1. Instructor 3. Associate Professor 5. Other _____
   2. Assistant Professor 4. Full Professor _____

6. Faculty status this term:
   1. Full-time 2. Part-time 3. Other_____

Information Technology Background

Definition of Terms Used in This Questionnaire:
Computer - micro, mini and mainframe computers.
Video technologies - all forms of television, videotape, satellite, video teleconferencing, videodisc, etc.
Audio technologies - radio, audiotape, audio teleconferencing, etc.
Software materials - electronic and print materials for video, audio and computer technologies.

7. Have you had formal training in the instructional use of any of the following information technologies? (circle all that apply)
   1. Computers 3. Audio technologies
   2. Video technologies 4. None of the above

8. Please indicate which of the available responses best describes your current (last two academic years) level of use of computer, video and audio technologies in your courses. (Please check the most appropriate response for each technology).

	Don't Use	Sometimes Use	Often Use	Very Often Use
Computer	___	___	___	___
Video	___	___	___	___
Audio	___	___	___	___

9. Please indicate which of the available responses best describes the extent to which you encourage or require (E or R) your students to use each of these technologies for instructional purposes.

	Don't E or R	Sometimes E or R	Often E or R	Very Often E or R
Computer	___	___	___	___
Video	___	___	___	___
Audio	___	___	___	___

Computer - micro, mini and mainframe computers.
Video technologies - all forms of television, videotape, satellite, video teleconferencing, videodisc, etc.
Audio technologies - radio, audiotape, audio teleconferencing, etc.
Software materials - electronic and print materials for video, audio and computer technologies.

Obstacles to Use of Information Technology

The list below includes factors that some faculty say are obstacles or hindrances to their use of computer, video and audio technologies for instructional purposes. Please indicate the extent to which you agree or disagree that each of these factors is an obstacle or a hindrance for you, by circling the appropriate response for each technology.

SD = Strongly disagree
D = Disagree
A = Agree
SA = Strongly Agree
? = Don't know/no opinion

	Technologies					
10. The extensive amount of time required to learn how to use this technology for instruction.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
11. Lack of conveniently available training for faculty in the instructional use of this technology.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
12. Lack of high quality software materials available in my academic area for this technology.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
13. Lack of access to information about what software materials are available in my academic area for this technology.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
14. The legal and financial complications of recording or copying software materials for student and faculty use.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
15. Inadequate on-campus technical assistance to help faculty with hardware or software problems.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
16. Lack of institutional funds to adequately support instructional use of this technology.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
17. Lack of commitment by institutional leadership to increasing the use of this technology.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
18. My own concerns about the long-term negative impact of this technology on higher education.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
19. Lack of evaluative information about the quality of software available for this technology.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?

Computer - micro, mini and mainframe computers.
Video technologies - all forms of television, videotape, satellite, video teleconferencing, videodisc, etc.
Audio technologies - radio, audiotape, audio teleconferencing, etc.
Software materials - electronic and print materials for video, audio and computer technologies.

	Technologies					
20. Lack of convenient access to hardware (e.g., computers, videotape players, audio conferencing equipment).	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
21. Lack of sufficient incentives or rewards for using this technology to improve instruction.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
22. Inadequate integration of the print (manuals, student guides, texts, etc.) and the electronic components of software materials.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
23. Insufficient opportunities to review software materials prior to deciding to use them.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
24. Using this technology for instruction adds too much extra time to the faculty work week.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?

25. Other _____

_____

Reasons for Using Information Technologies

Educators cite various reasons for incorporating information technologies into their courses. Please indicate the extent to which you agree or disagree that each of the following items is a reason for you to incorporate each technology into your courses by checking the appropriate response.

SD = Strongly disagree
D = Disagree
A = Agree
SA = Strongly Agree
? = Don't know/no opinion

	Technologies					
26. To help motivate students to be more interested in the content of the course.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
27. To reduce the need for me to use class time to repeat basic course content information.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
28. To help students develop specific abilities (e.g., problem-solving, analysis, writing, visualizing, etc.).	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
29. To help students learn important concepts or skills that are particularly difficult to master.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?

Computer - micro, mini and mainframe computers.
Video technologies - all forms of television, videotape, satellite, video teleconferencing, videodisc, etc.
Audio technologies - radio, audiotape, audio teleconferencing, etc.
Software materials - electronic and print materials for video, audio and computer technologies.

	Technologies					
30. To help students appreciate times, places, people and events that cannot be experienced in a conventional classroom.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
31. To help convey relationships between abstract concepts and concrete experiences.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
32. To encourage students to be more active learners.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
33. To make it easier to deal with differences in the learning styles and abilities of students in the same class.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
34. To enable students to experience real-world problems in a safe, manageable or cost-effective manner (e.g., simulations, experiments).	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
35. To respond to students' expectations that this technology should be used in college-level courses.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
36. To increase opportunities for student-faculty interaction.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
37. To deliver instruction to students in off-campus settings (e.g., home, workplace, learning centers).	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
38. To increase my effectiveness as a teacher.	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?
39. To help me manage my courses (grading, recordkeeping, assessment, diagnosis).	Computer	SD	D	A	SA	?
	Video	SD	D	A	SA	?
	Audio	SD	D	A	SA	?

40. Other _____

APPENDIX C

PHASE III SOFTWARE DESCRIPTIONS
(of videotaped software segments)

Learning and Technology Services
Raymond J. Lewis, Director
Phone: (503) 256-4187
P.O. Box 30207
Portland, OR 97230

INSTRUCTIONAL APPLICATIONS OF INFORMATION TECHNOLOGIES: A SAMPLE

Science, Math and Business

Video Segments

1. Math: Factoring
   Peralta Community College District
   Instructional Problem: Teaching students how to master a specific skill (i.e., factoring polynomials).
   Contact: Roger Ferragallo
   Telecommunications
   Peralta Community College District
   333 East Eighth Street
   Oakland, CA 94606
   Phone: (415) 466-7240

2. The Mechanical Universe: Newton's Laws
   Annenberg/CPB Project and the Corporation for Community College Television
   Instructional Problem: Conveying the relationship between a theoretical concept and concrete experience.
   Contact: Ginny Goldstein
   Public Broadcasting Service
   Adult Learning Programming Service
   475 L'Enfant Plaza SW
   Washington, D.C. 20024
   Phone: (202) 488-5360

3. The Brain: Madness
   Annenberg/CPB Project and WNET/TV, New York
   Instructional Problem: Conveying an appreciation for circumstances that cannot be experienced directly in a conventional classroom.
   Contact: Ginny Goldstein (See above for address)

4. Computer-Assisted Design/Computer-Assisted Manufacturing (CAD/CAM)
   Milwaukee Area Technical College
   Instructional Problem: Enabling students to experience real-world problems in a safe, manageable and cost-effective manner (i.e., CAD/CAM).
   Contact: Victor Langer, MATC-CAD
   Milwaukee Area Technical College
   1015 North Sixth Street
   Milwaukee, WI 53203
   Phone: (414) 278-6743

Audio Segment

5. Audio Teleconferencing
University of Wisconsin-Extension
Instructional Problem: Conveying a variety of educational content to students in settings that are distant from the campus.
Contact: Marcia Baird
Instructional Communication Systems
University of Wisconsin-Extension
Old Radio Hall
975 Observatory Drive
Madison, WI 53706
Phone: (608) 262-4342

Computer Segments

6. PeriChart (Macintosh)
Drexel University
Instructional Problem: Conveying factual information to students that is prerequisite knowledge for further study (i.e., the periodical table).
Contact: Shirley C. Smith
Special Projects Coordinator
Microcomputing Program
Drexel University
Philadelphia, PA 19104
Phone: (215) 895-2203

7. Molecular Editor (Macintosh)
Drexel University
Instructional Problem: Helping students to learn about and visualize phenomena that are too small to see and difficult to represent in physical models (i.e., the structure of molecules).
Contact: Shirley C. Smith (See Item 6 for address)

8. Biznes: A Simulation of a Firm (Apple II)
CONDUIT and St. Joseph's College, Indiana
Instructional Problem: Conveying the relationship between abstract concepts and concrete experience (i.e., the law of diminishing returns).
Contact: James Leaven
CONDUIT
University of Iowa
Oakdale Campus
Iowa City, IA 52242
Phone: (319) 353-5789

9. Kepler Orbits: For the Novice Deity (Macintosh)
Stanford University
Instructional Problem: Conveying an appreciation for the dynamics of planetary motion (e.g., velocity, position, orbit).
Contact: Michael Carter, Director
IRIS/ACIS
Stanford University
Cypress Hall, Room E-7
Stanford, CA 94305
Phone: (415) 497-2868

10. Quake (IBM-PC)
Southern Illinois University
Instructional Problem: Giving students access to environmental systems that are too large, distant or slow-changing to be observed directly (i.e., earthquake distribution and location).
Contact: David M. Sharpe
Department of Geography
Southern Illinois University
Carbondale, IL 62901
Phone: (618) 536-3375

11. Airlab (IBM-PC)
Southern Illinois University
Instructional Problem: Giving students access to environmnetal systems that are too large, distant or slow-changing to be observed directly (i.e., humidity in the atmosphere).
Contact: David M. Sharp (See above for address)

12. Heartlab (IBM-PC)
Washington State University
Instructional Problem: Conveying an understanding of the complex interactions of cardiac mechanics by allowing students to re-create historic experiments.
Contact: Nils Peterson
Department of Veterinary and Comparative Anatomy, Pharmacology and Physiology
College of Veterinary Medicine
Washington State University
Pullman, WA 99164
Phone: (509) 335-6621

13. Hydrologic Cycle (IBM-PC)
IBM Personal Computer Software
Instructional Problem: Conveying an understanding of basic facts and concepts associated with a large environmental system (i.e., the hydrologic cycle).
Contact: IBM Personal Computer Sales and Service
P. O. Box 1328-W
Boca Raton, FL 33432
(Available in retail computer stores.)

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INSTRUCTIONAL APPLICATIONS OF INFORMATION TECHNOLOGIES: A SAMPLE

Social Sciences, Humanities and Fine Arts

Video Segments

1. Silkscreening
   Peralta Community College District
   Instructional Problem: Teaching students how to master a specific skill (i.e., silkscreening).
   Contact: Roger Ferragallo
   Peralta Community College District
   333 East Eighth Street
   Oakland, CA 94606
   Phone: (415) 466-7240

2. The Artist: What He/She Does and Why
   University of South Florida
   Instructional Problem: Conveying an appreciation for how an artist uses his or her medium to communicate an idea.
   Contact: Thomas C. Wilson, Director
   The Open University
   University of South Florida
   SVC 116
   Tampa, FL 33620
   Phone: (813) 974-2864

3. Faces of Culture: The Aymara: A Case of Social Stratification
   Coast Community College District
   Instructional Problem: Conveying the relationship between a theoretical concept and concrete experience.
   Contact: Leslie Purdy
   Coastline Community College
   11460 Warner Avenue
   Fountain Valley, CA 92708
   Phone: (714) 241-6221

4. The Write Course: Outlining
   Annenberg/CPB Project and Dallas County Community College District
   Instructional Problem: Encouraging the development of specific skills (i.e., outlining).
   Contact: Ginny Goldstein
   Adult Learning Programming Service
   Public Broadcasting Service
   475 L'Enfant Plaza SW
   Washington, D.C. 20024
   Phone: (202) 488-5360

5. The Constitution: That Delicate Balance
Annenberg/CPB Project, Columbia University, WNET/New York, WTTW/Chicago
Instructional Problem: Conveying an appreciation for the complexities of constitutional law issues (i.e., The War Powers Act).
Contact: Ginny Goldstein (See above for address)

Audio Segment

6. Audio Teleconferencing
University of Wisconsin-Extension
Instructional Problem: Conveying a variety of educational content to students in settings that are distant from the campus.
Contact: Marcia Baird
Instructional Communication Systems
University of Wisconsin-Extension
Old Radio Hall
975 Observatory Drive
Madison, WI 53706
Phone: (608) 262-4342

Computer Segments

7. The Would-Be Gentleman (Macintosh)
Stanford University
Instructional Problem: Conveying an appreciation for times, places and events that cannot be experienced in the conventional classroom (i.e., interrelationships between economic, social and political conditions of 17th century France).
Contact: Michael Carter, Director
IRIS/ACIS
Stanford University
Cypress Hall, Room E-7
Stanford, CA 94305
Phone: (415) 497-2868

8. Theatergame (Macintosh)
Stanford University
Instructional Problem: Helping students visualize circumstances that are difficult or expensive to reproduce in the learning environment (i.e., alternative positions of characters and props on a stage).
Contact: Michael Carter, Director (See above for address)

9. Tools for Writers (Macintosh)
Drexel University
Instructional Problem: Helping students develop analysis skills that will improve their writing.
Contact: Shirley C. Smith
Special Projects Coordinator
Microcomputing Program
Drexel University
Philadelphia, PA 19104
Phone: (215) 895-2203

10. Community Mental Health Model (Apple, IBM-PC)
North Carolina State University
Instructional Problem: Conveying an appreciation for complex inter-relationships among sociological variables.
Contact: G. David Garson
Social Science Micro-computer Review
Software Department
P. O. Box 8101
North Carolina State University
Raleigh, NC 27695
Phone: (919) 737-3067

11. State Data Systems (Apple, IBM-PC)
North Carolina State University
Instructional Problem: Conveying an appreciation for complex inter-relationships among sociological, political and demographic variables.
Contact: G. David Garson (See above for address)

12. Psychworld (Apple, IBM-PC)
McGraw-Hill Book Company and University of Wisconsin-Milwaukee
Instructional Problem: Enabling students to explore psychological concepts through active experimentation.
Contact: Debie K. Dennis
Senior Marketing Manager
Computing and Educational Software
McGraw-Hill Book Company
1221 Avenue of the Americas
New York, NY 10020
Phone: (212) 512-6611

APPENDIX D

TECHNOLOGY USE VARIABLE

The technology use variable was derived by combining a respondent's scores on questions eight and nine on the Phase III questionnaire. Question eight asked faculty to indicate their current use of computer, video and audio technologies in their courses and question nine asked them to what extent they encourage or require their students to use these tehcnologies. All respondents who answered these two questions ended up with a numerical score from 1-4 for each technology on each question. By combinging the respondent's two computer scores (questions 8 and 9) we arrived at a technology use score for computers. The same procedure was followed for video and audio. On each technology it was possible for a respondent to have a technology use score varying from 1-8.

Technology use categories were then determined by the respondent's score.

	Score
Non-User =	1-2
Moderate User=	3-5
Heavy User=	6-8